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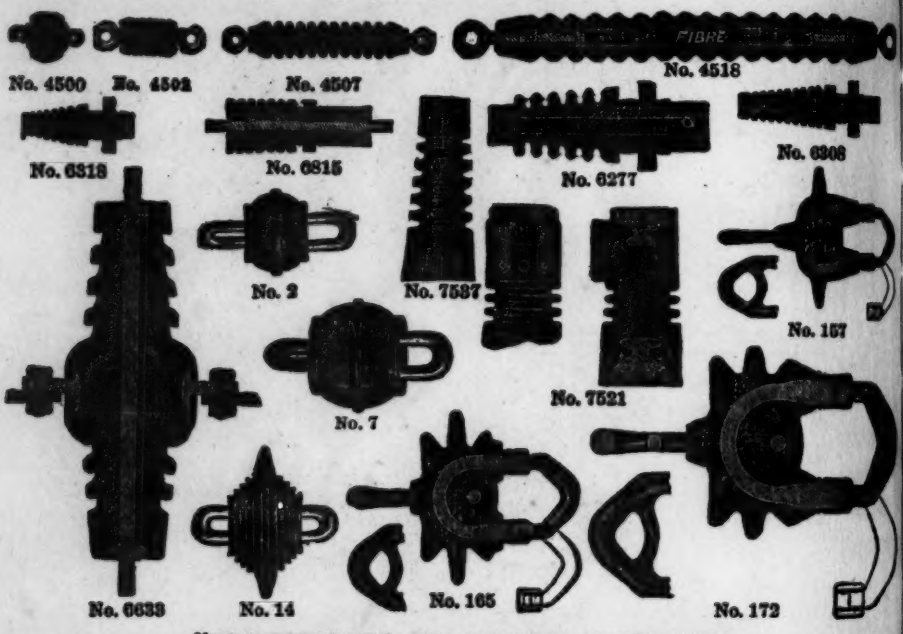

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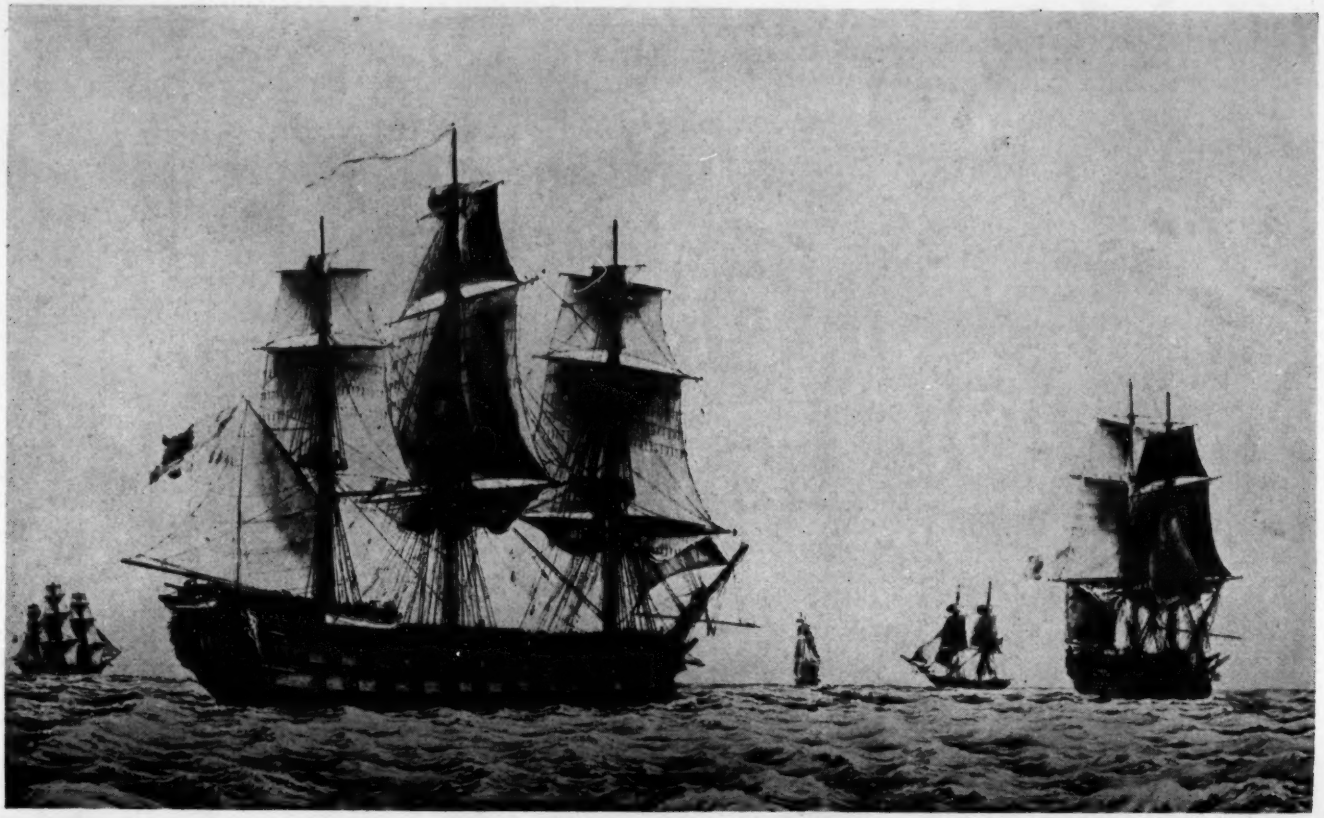

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MEN OF WAR A CENTURY AGO.

Types of ships-of-the-line, frigates, and sloops of war, in which great sea fights like Quiberon Bay and the Capes of the Chesapeake, for America as prize, were fought.

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SEA POWER AND AMERICAN DESTINY

By HERMAN F. KRAFFT,
Associate Professor, United States Naval Academy

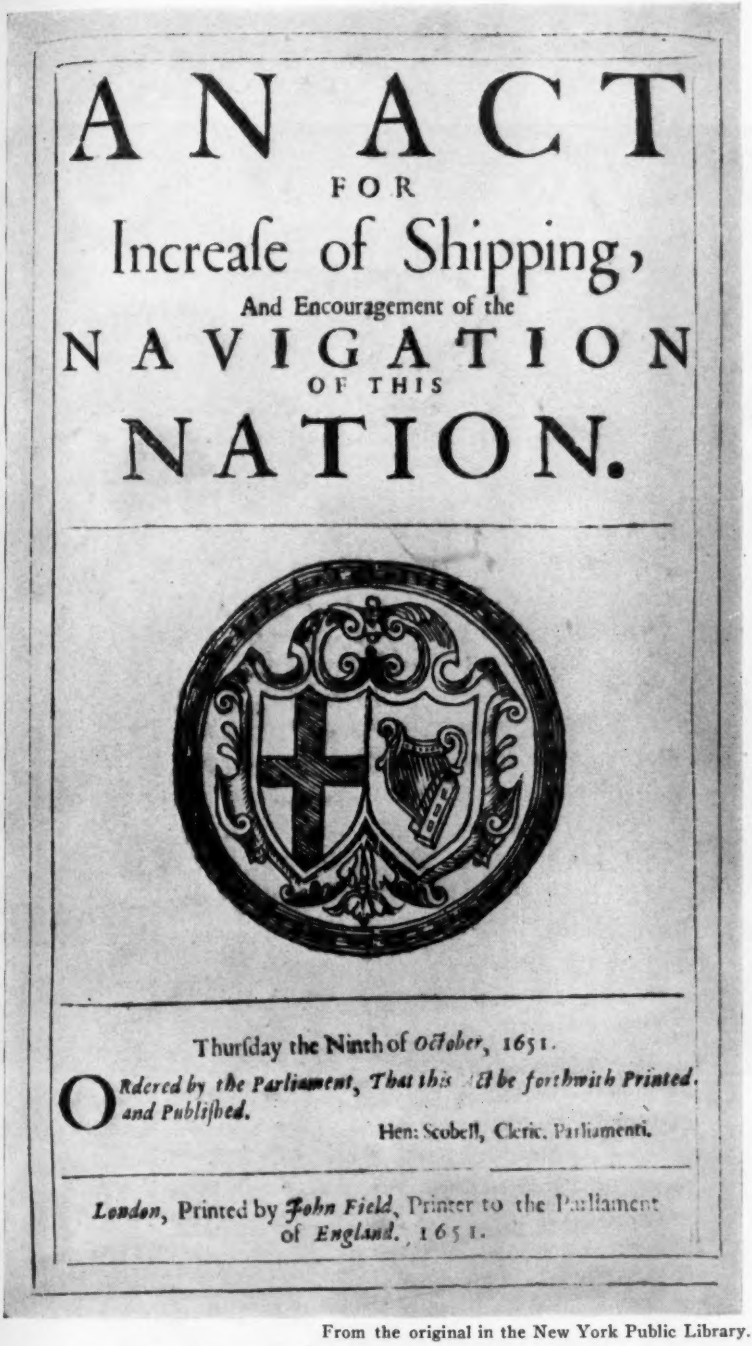
In seven of the eight wars waged by the United States since 1775, navies had, to borrow a phrase of George Washington, "the casting vote." Perhaps more exactly we should say that in these seven wars sea power—rather than navies alone, which form only one element of sea power—was, in the last analysis, the decisive instrument. Transmarine wars would be impossible without the transference of armed forces to the theater of operations and without the continued maintenance of the communications of such forces. These communications are the functions of navies and merchant marines. To borrow a trenchant phrase of Admiral Mahan, "Communications dominate war."

Sea power, as used by naval writers, is a wider term than military navies. It may be defined as the combination of all those means which a nation can bring to bear to gain and keep control of the sea. It embraces therefore such factors as a location with good harbors on great waters facing the highways of commerce; a productive, commercial, and sea-faring population to furnish the means of trade, and the artisans and sailors to build and man commercial and naval fleets; colonies to exchange products with, to furnish coaling, repair, supply stations, and ports for fleets to operate from against enemies and to seek refuge in; and finally a

navy proper to weld together and protect this whole combination of production, commerce, trade routes, bases and colonies. Great Britain, which has all these elements, has been for centuries and is to-day the best illustration of sea power.

Before we consider the influence of American sea power as a decisive instrument in American history, let us take a glance at the influence of British sea power in winning North America for the Anglo-Saxon race. America, which was discovered by the aid lent to Columbus by the greatest sea power of his time, Spain, was lost to Spain by the rise of a greater sea power, Britain. The defeat of the Armada, 1588, wrested from Spain the control of the seas and paved the way for English colonization of North America. A century later, under Cromwell and William of Orange, British sea power defeated another rival, Holland, and by its superiority at sea was able to acquire the Dutch colonies and trade in North America and so to unite the Atlantic seaboard from Maine to Florida under the British flag. Finally after another century British sea power defeated a third rival for America, France. As a result of this crushing victory over France in the Seven Years' War, England got by the Peace of Paris, 1763, all of North America east of the Mississippi River. This great result was brought about not only by England's navy, but still more by her vast commerce, which then as in later wars furnished the support for great coalitions against her enemies. In a war of attrition, Great Britain, leaning heavily on her commerce and colonies, could wear out the most powerful combinations against her.

In this Seven Years' War, the sea power of the American Colonies had an important and decisive influence. These colonies, which had till within half a century before been dependent on the mother country for food, were now able from their great surplus to export grain for the support of the mother country. With a commerce carried in five hundred and fifty American bottoms and with vast fisheries the colonies financed the war to a large degree. The reader will recall Burke's glowing tribute in Parliament to the extraordinary growth of colonial commerce which, he says, had reached a total in 1770 equal to half of England's at this time, and to the whole of England's seventy years before. Of the American fisheries—an important result of colo-



AN ACT
FOR
Increaſe of Shipping,
And Encouragement of the
NAVIGATION
OF THIS
NATION.

Thurſday the Ninth of *October*, 1651.

Ordered by the Parliament, That this Act be forthwith Printed and Publiſhed.

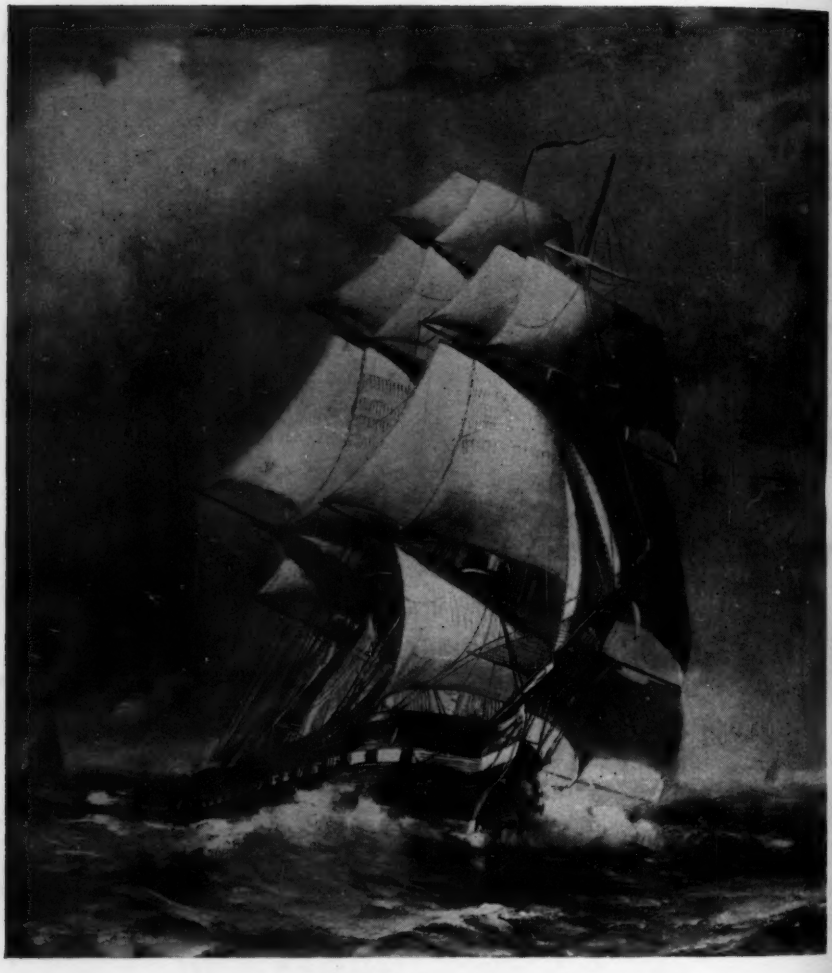
Hen: Scobell, Cleric. Parliamenti.

London, Printed by *John Field*, Printer to the Parliament of *England*. 1651.

From the original in the New York Public Library.

TITLE PAGE OF CROMWELL'S NAVIGATION ACT.

The corner-stone of England's sea power, a prolific cause of wars, for example of the American Revolution and the War of 1812. This act, which required all British imports and exports between England, Asia, Africa, America, and to a less degree from the continent, to be in British bottoms, remained in force for 200 years.



THE CONSTITUTION.

The ship which more than any other inspired respect for American sea power in the early days of the republic.

"Aye, tear her tattered ensign down,
Furl every threadbare sail,
And give her to the god of storms,
The lightning and the gale."

—*Old Ironsides,* Holmes.

nial ship-building and trained sailors, and therefore a factor of sea power—he says:

> Look at the manner in which the people of New England have of late carried on the whale fishery. . . . . We know that whilst some of them draw the line and strike the harpoon on the coast of Africa, others run the longitude and pursue their gigantic game on the coast of Brazil. No sea but is vexed by their fisheries; no climate but is not witness to their toils. Neither the perseverance of Holland, nor the activity of France, nor the dexterous and firm sagacity of English enterprise ever carried this most perilous mode of hardy industry to the extent to which it has been carried by this recent people; a people who are still, as it were, but in the gristle, and not yet hardened into the bone of manhood.

What colonial sea power, therefore, had helped the mother country to wrest from the French in 1763, colonial sea power, aided by French sea power, wrested from the mother country a score of years later. The French felt keenly the humiliation of the Treaty of Paris of 1763, and accordingly plotted in and out of season to force Britain to relinquish the fruits of her victory. If France could not win back America, she was determined that England should not keep it. Her diplomats made skilful use of the growing discontent in the American Colonies. The celebrated French author of "The Marriage of Figaro," Beaumarchais, secretly sent vast stores of munitions, tents, and uniforms to the struggling colonies. In the two critical periods of the American Revolution, American sea power played the decisive rôle in one and French sea power in the other.

During this war there were two strategic battles and only two, Saratoga and Yorktown, in each of which navies had, to borrow Washington's term again, "the casting vote." In the fall before the battle of Saratoga, Benedict Arnold fought with the British on Lake Champlain, the water route and therefore in those days the only route to New York, a lake action with row galleys, "a battle of pigmies for a continent," as Mahan calls it. Arnold won in this respect, that he forced the British to postpone their invasion of the colonies for a year and so gave the colonials a chance to concentrate during the winter for defense the next spring. Hence, when the British renewed the attempted invasion under Burgoyne in 1777, the colonials were ready, as they were not the previous year, and Burgoyne's whole army surrendered—a direct result of Arnold's tiny naval force. The second battle, Yorktown, was likewise made decisive by the help of sea power—a help which

Washington acknowledged in the most generous terms.[1] The American general with superb strategy had kept, through a scout frigate, in close communication with the French Admiral DeGrasse. By reason of the most careful co-operation so arranged, DeGrasse managed to outwit the British admirals on the coast. He appeared off the capes of the Chesapeake at the psychological moment and was able to keep at bay the British Admiral Graves coming to the relief of Cornwallis, whose communications were entirely dependent on the sea. The result, as we all know, was the surrender of Cornwallis at Yorktown and the end of the war for America. What Americans do not always realize in this battle is the vital importance of the sea fight off the capes between DeGrasse and Graves, an indebtedness to France far greater than that for Lafayette's help—an indebtedness that we can the more generously acknowledge now that the debt has been repaid. Of course the little American Navy under such men as Barry, Wickes, Conyngham, and especially under John Paul Jones, helped a great deal in harrying British commerce. But with the last three of these commanders again the debt was great to France, for she helped very much, at first secretly, and after 1778 openly, in making their harassment of the Mistress of the Seas decisive. For it was during these middle years of the American Revolution that the French-Spanish fleet for the first time in many years held a temporary control of the English Channel. Therefore, to sum up, we must acknowledge that sea power, colonial and especially French, was the decisive factor in the battles of Saratoga and Yorktown and won for the colonies their independence.

The United States, thus aided by French sea power to its independence, was early in the administration of Washington called upon by France to repay the debt by means of American sea power. The French Revolution, beginning in 1789, was to last for twenty-six years and was to bring the United States into

[1] For example, in his letters to DeGrasse of October 20, 1781, and of October 28, 1781, from which the following two excerpts are taken. For complete letters see Ford, "Writings of George Washington," lx, 389, 399:

"The surrender of York (town), from which so much glory and advantage are derived to the allies, and the honor of which belongs to your Excellency, has greatly anticipated our most sanguine expectations."

"Your Excellency will have observed that, whatever efforts are made by the land armies, the navy must have the casting vote in the present contest."

armed conflict with each of the two great belligerents and also with the Barbary pirates before the quarter of a century of European wars ended. Four years after the beginning of the revolution, in 1793, England and her sea power were once more aligned against France. The British Navy had, after the American Revolution, won the battle of Saints' Passage and so reasserted its control of the sea. As in other periods, the British Navy, leaning on its vast sea resources, had quickly rejuvenated itself after its spell of deterioration. Thus at the outbreak of war, Britain's control of the sea forced France to a privateer war. The new French Republic sent a Von Bernstorff in the person of Citizen Genet to the United States to buy supplies for France and to operate privateers from American ports against British shipping. Genet bullied the Republicans into sympathy with France and tried, but unsuccessfully, to bully Washington in his brazen interference with American neutrality. Under Genet's intrigues relations with Great Britain became so strained that Washington sent Jay to England, who negotiated the treaty bearing his name, 1794, by which the United States practically agreed not to allow its merchant marine to carry supplies to France. As the latter's merchant marine had been driven from the seas, she had tried to substitute American bottoms to carry on her West Indian-French commerce. She had been attempting to make neutral America render service which she herself, not having control of the sea, could not render for herself. Great Britain by reviving her rule of 1756 maintained that America in thus carrying on France's commerce was acting practically as a belligerent. Jay's Treaty ended this illicit trade and so caused France to retaliate by seizing American merchantmen in the West Indies. The young American republic, forestalling trouble with Algiers and other pirates, had built the nucleus of a navy in 1794 in the construction of the frigates *United States, Constitution* and *Constellation*. With this naval force the United States in 1798 to 1800 convoyed American merchantmen to and from the West Indies and captured several French cruisers. This so-called "Naval War with France" ended when Napoleon took control of France, who signed a new treaty of peace with the United States. America, under the wise guidance of Washington, who believed in no entangling alliances with either belligerent, had been desirous of maintaining a strict neutrality; it was willing to sell goods to either belligerent. Un-

fortunately for France, as for Germany in 1914, England had control of the sea, and therefore the neutrality of the United States, however strict it might be, could help only the belligerent controlling the highways of commerce. In this short naval war with France, therefore, the young navy of the United States prevented the preying on American shipping by the weaker European belligerent and upheld the neutrality and the dignity of the United States. American sea power, unaided by armies, won this second war in our history.

Shortly after the war with France, American sea power, again unassisted by armies, waged a decisive contest with the pirates of Tripoli, 1801-1804, a contest that resulted from the great European war. America, whose trade at this time was second to England's, was carrying on an extensive commerce in the Mediterranean, where British trade was handicapped by a split-control ended by the great sea fight of Trafalgar in 1805. The Barbary pirates took advantage of the general disorganization in Europe and also of the jealous connivance of the British, who secretly fostered the depredations of the Barbary corsairs against their American trade rivals in the Mediterranean. By the brilliant exploits of American officers like Preble and Decatur, Tripoli was brought to terms, and the system of extortion, blackmail, tribute paying, and white slavery, tolerated for centuries by the civilized nations of Europe, was ended by the long reach of a young sea power three thousand miles away. Even Britain, with all her boasted mastery of the seas, had not been free from tribute paying to these nests of corsairs. After the Napoleonic wars England sent a powerful expedition under Lord Exmouth to Algiers and so ended piracy and white slavery in Barbary States forever. But American sea power had blazed the way.

We have now seen that the United States was drawn into two purely naval wars—the "French War" and the Tripolitan War—by the general chaos of the Napoleonic era in Europe. We must note in passing also that these two American wars were waged in the interests of neutrality and of freedom of the seas. But the sea power of the United States was to be forced to defend these same principles of neutral rights and free seas a third time during the Napoleonic wars. In this instance—the War of 1812—the sea power of the United States was to be pitted against the second of the two great belligerents of the Napoleonic era—against the Mistress of the Seas.

Just as the causes of the former two of these three American wars were based on depredations on the American merchant marine and were decided by sea power, so this War of 1812 was naval in origin and in its decisive features. As the American reader remembers only too well, the causes of the War of 1812 were illegal seizures and searches of American merchantmen and impressment of American seamen. In order to neutralize Napoleon's paper blockades of the British Isles and commerce, and in order to thwart Napoleon's Continental System, by which he tried to keep English products out of Europe, and thus destroy the great sea revenues of the coalitions against him—in other words, in order to maintain British commerce as the sinews of war and at the same time to deprive Napoleon of these limitless resources—England went to such extremes in regulating ocean traffic that she by her orders in Council coerced all neutral trade to her ends or drove it off the seas. Hence American commerce, which during the years 1807 to 1810 at times exceeded Britain's tonnage, was slowly but surely being driven from the seas by the violence and cupidity of both Napoleon and Great Britain. True, this annihilation of American commerce was unintentionally abetted by the President and Congress of the United States by the latters' restrictions on American trade, which helped to embargo it to death. These restrictions and British and French depredations in their ultimate effects not only ruined thousands of American ship owners but brought suffering and unemployment to greater thousands and changed the whole character of New England from a commercial to an industrial community. But, as in the recent World War, the depredations on property, while ruinous, did not touch the hearts of the people as the outrages on human liberty and lives. For Great Britain in her hour of need, in the struggle against the world dictator, a struggle that had already lasted twenty years, wanted men for her great marine and navy, and accordingly her officers boarded American merchantmen and even war ships and seized ruthlessly thousands of American citizens. This was the wrong that Americans of a hundred years ago felt more keenly than the mere loss of property. Great Britain was then, as a century later, really fighting with back to the wall against a great would-be world conqueror, but the people of the United States were blind to this fact by recent memories of George III's tyranny. As Mahan points out, Amer-

ica a century ago should have fought Napoleon, not England. But the wily Napoleon professed to have very "delicate ideas of the rights of non-combatants at sea, whither his power did not reach." He seized American ships wholesale without right or reason, just as he made of peoples on the continent tribute-paying Belgiums. But impressment was to the Americans of that day a more flagrant abuse of human rights than seizure of ships. It was to them somewhat like the ruthless disregard of human rights a century later by the German U-boats, and like the latter had a greater influence in forcing a pacific government and people to take sides against England rather than against the worse aggressor, Napoleon. After years of diplomatic note writing the American government declared war on June 19, 1812.

The War of 1812, therefore maritime in its origin, depended also on sea power for its decision. The United States entered the war—owing to the pacific ideals of the people and government—unprepared. We had an insignificant naval force of fourteen frigates and sloops of war, as against five to six hundred ships of the line and frigates in the British Navy actually in commission. But partly to make up for the lack of a national navy, the American people quickly transformed the idle American merchantmen into privateers, of which there were five hundred and twenty-six before the end of the war, whose depredations on British commerce had a considerable effect in the final peace. While the fourteen national warships in the American Navy won undying fame for themselves in their ocean duels with the *Guerriere, Java, Macedonian, Frolic, Shannon,* etc., under such leaders as Hull, Bainbridge, Decatur, Jacob Jones and Lawrence, still the odds of fourteen to a thousand were too great to influence the military result. The overwhelming British superiority in the Atlantic gradually blockaded the United States so tightly that hardly a fishing smack dared show itself even in its own Chesapeake Bay, which the British turned into a base from which their sailors and soldiers harassed the coast towns and burned the American capital.

But while American sea power on the ocean could do little but win glory in an unequal contest, on the Canadian border things were different. Here, after humiliating defeats to the raw American troops, the American Navy prevented a disastrous defensive. Perry by his victory on Lake Erie, September, 1813,

regained control for communications on the American left wing and forced the retirement from the Northwest of the British right wing. A year later, September, 1814, Commodore Macdonough by his crushing naval victory on Lake Champlain achieved what Mahan declares the decisive engagment of the war. This battle of Lake Champlain determined, even more than the first battle of Lake Champlain during the Revolution, the strategy of the war. For immediately upon the victory, Prevost, the Governor-General of Canada, with his fourteen thousand veterans from Wellington's army, retreated precipitately into Canada. The battle had a far reaching effect on the peace makers at Ghent, for it ultimately forced England to give up her demands on United States territory in Michigan and Maine. Moreover the decisive influence of these lake battles—that is, of sea power—on the war is seen from the following reply of Wellington, the conqueror of Napoleon, who in the emergency in Canada was asked to take command over here:

> Neither I nor any one else can achieve success, in the way of conquests, unless you have naval superiority on the lakes. . . . . The question is, whether we can obtain this naval superiority on the lakes. If we cannot, I shall do you little good in America; and I shall go there only to prove the truth of Provost's defense, and to sign a peace which might as well be signed now.[2]

After the War of 1812 the setback suffered by the American merchant marine from the Napoleonic Wars crippled the sea power of the United States for half a century. For the navy too this period was one of stagnation and deterioration. Farragut complained in 1839 that our navy was forty years behind the navies of Europe. Hence, the Mexican War is the only one of the eight wars fought by the United States from 1775 to the present in which American sea power played practically no part. Farragut made every effort to rouse the Navy Department of that day to take a leading part in capturing the Mexican stronghold San Juan de Ulloa that protected Vera Cruz, but he was overruled and felt the disappointment keenly; to him it was the loss of an opportunity to end the war quickly. This whole period lends color to the contention that a merchant marine and a navy are mutually interdependent, acting as cause and effect upon each other, the

[2] Wellington to Liverpool, Nov. 18, 1814, Castlereagh Letters, Series III., Vol. II, 203.

one fostering the other. An active ocean commerce furnishes the trained shipbuilders, skilled seamen, and revenues wherewith to build and man a navy. Moreover, such a merchant marine gives the people a proper reason for maintaining a navy to protect its commerce. Without such commerce, the maintenance of a big navy seems to a democratic people too much like militarism, too much like a great waste of public money. Where the two elements coexist—merchant marine and navy—they form a natural evolution, like the expansion of great cities and their concomitant metropolitan police forces. Towards the middle of the 19th century, however, the American ocean shipping had a revival, for the fast American clipper ships ran for a while close rivals of Great Britain for the trade of the world. Americans, though busy with the winning of the West, again turned their faces seaward, toward the sea route to California and the China trade, and so contributed with their merchant ships in no slight degree towards the rapid expansion of the navy at the outbreak of the Civil War.

With these elements of sea power ready at hand, it is not surprising that the sea power of the Union was able to assemble within six months of the beginning of the Civil War a naval force of two hundred and sixty-one vessels wherewith to blockade effectively the coast line of 3500 miles from Hampton Roads to the Rio Grande. This coast line with its numerous and fine harbors was on the other hand for the Confederacy, which had no merchant marine or navy, only a great handicap—only a ready means for the sea power of her enemy to strike her quickly in as many vital spots as she had harbors. The Union navy soon seized the more unprotected harbors to use as bases for military operations against the South and so converted gradually and surely the blockade into a military occupation of the whole southern coast. Moreover, the Union fleets could and did make the Mississippi a great line for northern communications, thus helping to capture the fortress Vicksburg, and split the South in two, cutting it off from the food supplies of the states bordering the Great Father of Waters on the west; for the Confederacy, whose immediate territory was early demoralized by war, had quickly become dependent on the quieter states west of the river. Moreover, as the South was agricultural, it depended almost entirely on Europe, that is, on England, for uniforms, munitions, and all military equipment, which it paid for with its cotton that brought war prices in London. So great did the demand for cotton in

England and for munitions in the South become that a blockade runner could pay for itself in one successful round trip. But as the Union blockade tightened, it surrounded the South on three sides with a ring of iron, the so-called "Anaconda policy"—constriction from all sides. As the South was by the blockade cut off from the sources of manufactured articles, so vital to war, it is remarkable that it could hold out for four years. Without the Northern Blockade the South might have protracted the struggle indefinitely.[3] As it was, Lee's armies towards the last were in rags, without shoes, powder and arms, and were on half rations. Moreover the blockade had so crippled the South financially that bread was selling in Richmond at three dollars a loaf in Confederate currency. Of course in retaliation for this slow strangulation the South with its British-bought cruisers, especially the *Florida, Alabama,* and *Shenandoah,* inflicted great damage on Northern shipping, estimated at $20,000,000, but such commerce warfare, while it might delay, could not stop the strangling process. In short, the blockade of the South by the sea power of the North was the most decisive single factor in the Civil War.[4]

In the long interval of peace after the Civil War the sea power of the United States steadily waned, but was revived just in time for the test required of it by the Spanish-American War. Even before the Civil War the famous American clippers in competition with British steamers were on the decline. Moreover, the Southern commerce destroyers, like the *Alabama,* and cheaper European labor had helped to throw American commerce into foreign bottoms. But in the early eighties of the last century the American people took a renewed interest in their navy, and in the "White Squadron" they formed the nucleus of a sea power independent in its origin and growth of a merchant marine. This start stimulated Americans to enter the field of steel ship construction. While the building of this new American Navy demonstrated the fact that such a navy could come into being without

[3] Mahan, "Sea Power in its Relations to the War of 1812," I, 148. "Cambridge Modern History," VII, 558.

[4] Mahan, "Major Operations of the Navies in the War of American Independence," 4.

See also Mahan's "Sea Power in its Relations to the War of 1812," I, 287.

the aid of the sea-going personnel and ship-building facilities afforded by the existence of a big ocean marine, still it remains true that a previously existing merchant marine would have helped greatly not only in the construction and maintenance of a naval force but would have furnished, in popular estimation at least, better reasons for spending moneys on naval armaments. Without such a commerce to foster navies and to be protected by navies, the latter seem always to popular governments as unnecessarily militaristic and imperialistic.

But while the word imperialism came into frequent use in America just before and during and after the Spanish-American War, the new sea power of the United States was used not for aggression but rather for the freeing of peoples from the aggression of older European systems. The Spanish-American War, which was brought to a quick decision by the naval battles of Manila Bay and Santiago, freed Cuba and the Philippines from a reactionary government, decadent since the days of the Armada, which now lost the last provinces of a once great empire. The sea power of America and Britain, backing up the Monroe Doctrine early in the century, had prevented Spain under the Holy Alliance from reconquering the revolted provinces of South America; and in the end of the century the sea power of America deprived Spain of the last vestiges of an autocratic empire and gained for the United States an empire founded on self-determination. After the war with Spain the United States was free to expand in the Caribbean, the gateway to Panama, and so American sea power had blazed the trail for a Panama Canal, the gateway to the Pacific and its trade. The period of isolation for the United States was over. A vast production, a growing navy and colonial expansion now pointed the way naturally for the creation of the largest element in sea power, a new and greater merchant marine.

This new and greater merchant marine was to be one of the results of the submarine menace in the World War, much the same as a century before American commerce was greatly stimulated by another great world war. And to-day as then America was to enter the struggle as a champion of neutrality and free seas. Not only were the causes in both wars maritime, but sea power—the sea power of Britain, later powerfully aided by America's—was to have "the casting vote." Admiral Mahan in "The Influence of Sea Power upon the French Revolution and Empire,"

Courtesy New York Shipbuilding Corporation.

DESTROYERS—THE MOST DECISIVE FACTOR AGAINST THE U-BOATS.

Courtesy United States Shipping Board.

THE FIFTY WAYS OF THE HOG ISLAND SHIPBUILDING PLANT.
AN AIRPLANE VIEW.

The rapid construction of merchantmen was the most important phase of

a scholarly and exhaustive argument, comes to the conclusion that Napoleon's final defeat at Waterloo was the result of his defeat at the sea battle of Trafalgar ten years before. Trafalgar settled the control of the sea in England's favor. After that it was a war of attrition between sea power and the continent, with the ultimate result that the resources of the world carried in ships proved greater than the resources of the continent of Europe. Napoleon's Continental System was, in Mahan's opinion, his ruin. In much the same way in the recent war the sea power of Great Britain, and later of America, in spite of the very efficient and dangerous German U-boats, kept the control of the sea and sustained the Allies and their communications in the war of attrition. Even Von Ludendorf, a witness for the defense, in his recent book admits that the two million Americans, carried across on a bridge of boats, was the decisive factor in the war. But the bridge of boats represents the communications of this great army and communications are the arteries of war. If "communications dominate war," sea power in the World War even more than in earlier wars governed communications.

On the entry of the United States into the world conflict on April 6, 1917, it had two great elements of sea power: vast resources in raw and manufactured products and the largest navy in its history, a navy ranking next to Germany's. The third element, an ocean merchant marine, it had to create. Bryce in his "American Commonwealth" says that one of the characteristics of the American people is their great energy in national crises. This characteristic was demonstrated in the crisis of 1917. With their great resources, inventive skill and energy, the Americans sent across vast supplies of food and munitions, manufactured new types of weapons against the submarine like the depth bomb and the specially devised mines, with 57,000 of which their navy accomplished the gigantic task of creating the North Sea mine barrage, 250 feet deep and extending from the Orkneys to Norway, a distance of 230 miles. The American people also speeded up naval construction to such an extent that they launched 83 destroyers, aggregating 98,281 tons, in nine months. The Mare Island yard, for example, launched a destroyer, the *Ward*, in 17½ days and completed it in 70 days from the laying of the keel. They added to their navy to October 1, 1918, 2 new battleships, 28 submarines, 355 submarine chasers and hundreds of

THE FIFTY WAYS OF THE HOG ISLAND SHIPBUILDING PLANT. AN AIRPLANE VIEW.
The rapid construction of merchantmen was the most important phase of
Courtesy United States Shipping Board.

vessels of every conceivable type acquired by purchase, or charter, from the great coastwise and lake commerce of the country. Moreover, their navy in man power increased from 65,777 on April 6, 1917, to 497,030 on Armistice Day—a rapid expansion that had to be brought about without the aid of a trained sea-going personnel which a previously existing ocean marine would have afforded ready made. Manned by these young men—rapidly trained at the Great Lakes Training School and other similar camps—the navy in its 321 transports carried across the Atlantic approximately half of Pershing's army and supplies and did practically the whole (82¾%) of the ocean convoying with its naval vessels.

But, as we have said before, the sea power of the United States lacked one vital factor, an ocean merchant marine, and this too the people of the United States through the Shipping Board and Emergency Fleet Corporation quickly created. These agencies by commandeering and unifying the shipyards of the United States speeded up construction of merchantmen. Among other achievements the Shipping Board—a corporation to-day larger than the Standard Oil Company—repaired the 103 German liners and transferred 54 of them to the Navy Department, which by means of these alone was able to transport half a million troops. Under the work of such agencies as the Shipping Board and Emergency Fleet Corporation we witnessed the paradoxical result that the greater the destruction by the submarine, the greater the merchant marine of the United States grew. Our total imports and exports amounted in 1913 to $4,000,000,000 and in 1918 to $9,000,000,000. We came out of the war with a vast merchant fleet, the last and greatest element in our sea power.

Without in any slightest degree detracting from the great achievements of Foch and Haig and Pershing, may we not conclude in the words of George Washington that sea power in this World War as in the earlier six wars—the Revolution, the "French War," the Tripolitan War, the War of 1812, the Civil War and the Spanish-American War—had the casting vote? Moreover, American sea power in every one of these seven wars threw in its decisive weight on the side of human liberty.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

LEADERSHIP OF MEN[1]

By CAPTAIN F. B. UPHAM, U. S. Navy

Motto: "Whatsoever ye would that men should do to you, do ye even so to them."

Leadership may be said to consist in establishing and in maintaining an *esprit de corps* within the unit, be that unit a gun division, a fire-room crew, a ship, a division or a fleet of ships, or the whole navy.

If a unit be without *esprit de corps,* it lacks leadership, lacks cohesion, loses men.[2]

It is the mission of the appointed leader to develop this *spirit of the unit.*

The very first essential in this development is that every individual be impressed with the fact of his own membership in the unit, that each be made to feel that *he belongs.* The fact of membership cannot be too strongly impressed upon newcomers.

Ostracism is resorted to when a unit desires to expel an undesirable member. Fellowship is extended to desirable ones. The normal human being dreads ostracism even as he yearns for fellowship.

[1] This paper received honorable mention in the competition for a cash prize offered by the commander-in-chief of the Atlantic fleet for the best paper on the subject given.

[2] We have recently experienced a percentage of desertions well above normal. This we are perhaps too ready to ascribe to low rates of pay. When we compare the end of the month balance in the service man's pocket with that of a man of his talents on shore, we may not be so sure that the charge of low pay is wholly correct. Perhaps some desertions, or failures to re-enlist, are chargeable to other causes—perhaps some even to unintelligent leadership. Of late years we have been compiling reports as to desertions from individual ships. Similar data as to desertions from individual divisions on board ship might throw some light on the subject.

The heart of the recruit (raw, awkward, unhappy, and probably homesick) is thus fertile soil in which to plant the seed of fellowship. So anxious is he to *belong* to *something*, to be a member of a "gang," that he will stand any reasonable amount of hazing or other form of initiation in order that he may shun the dread ostracism and qualify for fellowship.

By the very act of enlisting, the recruit has made a definite choice of the gang, organization, body or unit with which he seeks to cast his lot. By this action of his we know not only that he is obeying the human instinct to join something, but we know also that he wants to belong to the navy. Something in the prospects, or in the life, of the navy has appealed to him. Perhaps it is the uniform. There is said to be a psychology of uniform closely related to the "gang spirit." If this be the appeal to our recruit he has been even more specific in his choice when enlisting, for he has chosen not only a uniformed gang, but that particular gang that wears the navy uniform. Whatever it be that prompted his choice, it is his leader's first duty to foster this desire for membership in the navy, to show that uniform to be a *symbol of membership*, a symbol with a depth of meaning that cannot be grasped by one who does not *belong*.

There is another symbol of membership, not so readily understood, but which is equally important and which has equal depth of meaning when it is understood. That symbol is the military salute. The salute to the flag is understood to some extent, the salute to the individual to a less extent. The reason for this limited understanding is lack of education in the first case, with an element of the "personal matter" in the second. From being a symbol of membership in the same unit the exchange of salutes between individuals became associated with salutes rendered by recognized inferiors to superiors in countries less democratic than our own. The true nature of the military salute is that of a symbol of fellow-membership in a fighting unit, the younger or less experienced, or less responsibly placed taking the initiative. By learning to make the salute in this spirit the recruit has acquired another symbol. He is taking the second step toward qualifying for coveted membership in the unit.

Thus far the leader has been utilizing the "gang spirit" that prompted enlistment. Having impressed upon the recruit's consciousness the fact that he has "arrived" as a *member*, the

leader's next step will be to make membership so attractive in its spirit and in its accomplishments, as well as in its symbols, that sacrifices are readily made in order that it may continue.

Nor is the real leader satisfied with merely holding men in his unit against possible temptation to go elsewhere, or to desert. His ultimate aim in dealing with personnel is to keep trained men in his unit. Thus the percentage of re-enlistments among his men becomes an index of his success as a leader, just as desertions are a measure of failure. We all know the pleasure with which we learn that a good man has asked to re-enlist in our ship. We are glad that a trained man is to remain in the unit; but it is his tribute to leadership in our unit that brings gratification.

There are two main lines along which to make appeal to the recruit, namely, his own mission (ambition), and the mission of the unit to which he now belongs. In recognition of his youth, and of the limits of his horizon, we admit that his own mission must at first take first place in his mind. Hence the first appeal of the wise leader will be to the individual as such. If ambition be lacking, it must be inspired by appeal to pride. If a personal mission in life seems to be lacking, the leader will indicate one.

Having engendered the ambition to realize a personal mission, the leader manages to identify accomplishment of this along with accomplishment of the mission of the unit, and again by appeal to the "gang spirit."

Another line of appeal, and one perhaps quite as strong as either of the others, is that to loyalty, for loyalty plays a real part in the "gang spirit." There are loyalty to the cause, loyalty to the leader, and loyalty to subordinates. These are closely related, so closely in fact that there is danger of stressing the first and second at the expense of the third. Loyalty to the cause involves loyalty to the unit and to the leader. These are the goal of the leader. With them he can accomplish much. Without them he can accomplish little—or nothing. He attains them by unfailing loyalty to his subordinates. The leader jealous of the welfare and progress of his men will be ever on guard to defend their interests, to plead their cause—to interpose with request for suspended sentence, as at mast, assuming responsibility for reform on the part of offenders who are not wholly lost. This attitude on the part of the leader is returned in full by his man. To the extent

that he makes their cause his, they in turn make his cause theirs. His loyalty to them is amply reflected in loyalty to himself and to the mission of his unit. Offenders experiencing his defense of them, in so far as their cause is just, seek to remain within the law, to improve, to reform and to *per*form, in gratitude for his interest. Offenders become fewer. The tone of the unit is raised.

Particularly is loyalty to petty officers essential, that they may feel the support of their leader, and that they may seek further to merit it. It requires no small degree of discernment to render correct judgment as between some petty officers and their delinquent men. Only the study and knowledge of men, together with experience, can equip one with expert judgment; but each experience will be of benefit for the future. A petty officer possessed of leadership will not present difficulties of this nature; but one who is repeatedly complaining of his men, or calling for their punishment, would better be disrated as lacking leadership. However much of a seaman he may be, whatever of mechanical skill he may possess, he cannot be retained in a leader's billet without detriment to the spirit of the unit.

Before quitting the subject of loyalty let it be remarked, and not by any means in parenthesis, that loyalty to the mission of the smaller unit (division) must never be permitted to obscure the larger unit (ship) and its mission. The division's mission is not performed if it does not contribute wholly to the ship.

Much depends upon first impressions. The recruit making his first acquaintance with the service should receive the very best leadership available. A good officer will make the first impressions good ones. No leader can make good impressions unless he show in himself "a good example of virtue, honor, patriotism and subordination." This good impression may be greatly enhanced by a leader who, in his relations with subordinates, shows himself to be a capable mariner. He should be that of course, but also a great deal more. He should be as well a gentleman of liberal education, refined manners, punctilious courtesy, and the nicest sense of personal honor.

Ever is the leader under most searching scrutiny on the part of subordinates. He is under constant examination as to the degree of his knowledge, of his ability, of his skill in every branch of his profession, and in particular as to his ability in handling men under his tuition—his consideration for their welfare and

progress, his firmness in exacting correct performance of individual tasks.

Without wishing to detract in the least from the importance of ability and skill in other branches of our profession (excellence in them is of great assistance to the leader), the greater importance of leadership of men is urged. If leadership be among his own talents a leader will, by that fact, discover talents and skill among his subordinates, including leadership; and these will be at his command in accomplishing the mission of his unit.

In the administration of his unit the leader will find that "honesty is the best policy." Men will not follow one whom they cannot trust. The would-be leader who is tricky does not accomplish results. He may meet with minor successes, but in the end his false steps bring him to one that is fatal to ultimate success. None are quicker to realize a lack of honesty than are subordinates.

A failure on the part of the leader to be open and above-board with superiors, say, is known to them. At once they question his good faith with themselves. To them his failure is a demonstration of bad faith. They lose faith in him. They may not put the thought into words, or even be conscious of the thought itself, but their reaction is loss of faith in the leader.

More than that, his bad example will beget trickiness and deception among the less discriminating of his men. Carelessness that they might conceal during drill may result in loss of life to a shipmate.

Likewise, exact justice to all should be practised as cultivating faith in and acceptance of the leader's judgment. No punishment should be awarded that savors in the least of personal feeling. The offender must be shown that punishment follows offense as night follows the day—not as depending upon the whim of the leader, but in accordance with a schedule prescribed and applied to all alike, and known to all. A self-respecting man, knowing the penalty for his act, will take his medicine. No guilty man expects to escape. The duty of the leader is to see to it that the punishment is just, that it meets the offense, and that it safeguards the spirit of the unit.

The faith of the leader in his men makes strong appeal. Let any man know your estimate of him and he will strive to meet it. If your estimate be high, so will be his aim. No good man will wish to fall short, and a liberal estimate indicated to a mediocre,

or backward, man will almost always lift that man above his own estimate. It will stimulate his pride. Gaining pride in himself, there will follow pride in the unit. Unit pride indicates leadership.

Since no two men are more alike in temperament than in personal appearance, the leader must exercise a degree of tact that shall foster and preserve individuality and self-respect while at the same time imposing upon each member the imprint of the unit. This calls for patience in leading backward ones over rough spots.

Encouragement, commendation for even slight improvement, will go far toward success, while reproof and too hastily administered punishment are disheartening to beginners and should be withheld as long as there is hope of accomplishment otherwise. Words of encouragement should be spoken openly and even in the hearing of others—

> No meritorious act of a subordinate should escape attention or be left to pass without its reward, if even the reward be only one word of approval.

Many are the opportunities for rewarding the deserving. There are desirable billets to be filled, excursions to be made, chances for advancement along special lines, promotions to be made.

Reproof should be reserved for privacy. Men should be encouraged to keep their records clear. The leader will avoid as long as possible that repository of unsolved problems—the Report Book.

Honesty, justice, faith, are all of them attributes valuable to the leader as to persons otherwise engaged in life, but it may be said that the leader with these alone is not fully equipped—to them must be added tact.

The leader is neither a gang boss nor a driver. He is dealing with a higher order of humanity than requires either bossing or driving. Indeed, the order of intelligence of the subordinates with whom he is dealing is such that he himself must *qualify*. Practicing the other attributes, he has not yet qualified until he shall practice also tact.

The observance of rules is ever irksome to youth, but only because the individual youth is as yet raw material, crude and uninformed. His earlier breakings of the rules are largely due to ignorance or the lack of proper instruction. An ignorant person is to be pardoned and instructed. The leader will discriminate

as between the ignorant offender and the deliberate one. This is an early and a most important step in handling men.

Every recruit, however raw, is possessed of a certain degree of intelligence, and seldom is one so lacking as not to understand an earnest leader. Every recruit is open to instruction and, whether wittingly or not, is seeking knowledge. It is his right that he be given it with helpful tact.

It is to the leader that he comes in search of knowledge of how to handle himself, and of how to qualify for a place on the team. If the rules be handed out to him with a club his resentment is aroused. He is mortified, offended, repulsed. Whereas he had approached the situation in a receptive mood, he has by this gross act of a deficient leader shut himself up against both leader and rules. His reaction is best expressed by the words "To hell with him and rules."

Withal there is the leader's obligation to be firm, requiring instant response and correct performance. The imperative necessity for these on the part of subordinates is well set forth in a letter in the files of the War Department, as follows:

> Safety demands the habit of instant obedience.
>
> In the emergency of battle, when every condition tends to distract men's attention, and peril is on every side, safety for a command frequently lies only in its organized and co-ordinated activity; and this can proceed from one inspiration alone—the instant and unquestioning compliance by all with the voice of authority.
>
> This habit cannot be created in emergency and forgotten under other circumstances, but must result from practice which tolerates no exceptions either of persons or occasions.
>
> The relationship between officers and men, therefore, must be so arranged as to lead to this indispensable result; but this is entirely consistent with respect, sympathy and mutual consideration, and the best officers are those who have completely won the affection of their men.

Even if there were not this overshadowing obligation ever to be in training against the hour of battle, in the navy we have with us at all hours of the day and night the responsibility for the lives of our shipmates. A boat not properly hooked on, a hatchway not guarded, a life buoy not honestly tested and rigged, an ammunition car operated on a wrong signal—each of these has cost a life or a limb in the service, not once, but many times.

One of our most successful young officers kept a "personnel log" (card index) of his men. For each man there was a separate card upon which were entered the usual official data as to

name, rate, etc. To this were added matters of more personal nature, such as the amount and beneficiary of his allotment, condition of beneficiary, the amount of schooling the man had had, what sports most interested him, or those in which he had some skill, notes of his home town, other items of interest to the man that might develop during the course of a semi-confidential conference while the card was being made out.

Needless to relate that in learning all this, and in letting the newcomer see it being recorded, the officer at once established a personal relationship with the man, and so with every man in the division. This interest in them prompted desire on their part to make good in his eyes. They strove for his commendation. Few of them became acquainted with the mast. Knowing of the entries on his personal card, a man in trouble went naturally to his division officer for counsel and advice, feeling that his problems would be met with helpful sympathy—and those problems included, as often as not, matters of welfare at home.

Is there room for doubt as to the leadership of that officer? Is there surprise that he was successful? Consider the attitude of his men when tackling a job put up to the division, each man putting forth his greatest strength, his greatest skill, his keenest wit, toward putting over the division's job—each actuated by the spirit of the unit!

Practicing true leadership, this officer fostered leadership among his men. His petty officers were charged with responsibility, each to the limit of his capabilities. The personnel of the division was divided into squads with a petty officer leader of each, charged with the supervision of the clothing and bedding outfits of his men, and required to take active part in their instruction and work. Competition among squads raised the general standing of the division.

In the same ship, as it so happened, the chaplain had card indexed the men with reference to their home ports and towns, with entries as to name and address of next of kin. Upon arrival of the ship in any port included in the index the chaplain's duty was to visit all the homes of men in or near that port. (The welfare fund was drawn upon to meet expenses of his transportation, and the money was well spent.) The chaplain carried with him to each home a message of courtesy from the captain of the ship. The welcome received at every home was such as

to confirm a personal relationship that lasted long after any man concerned had been transferred or discharged. The whole navy was done lasting good by those visits.

The chaplain was called in to baptise the little ones at home, to marry the sailor lad to the girl of his choice, or to perform the sad rites of laying away those who had passed on. Our division officer—he of the personnel log—was quick to see in the chaplain's activities a means of gaining closer hold on his men.

Interest thus shown in the home folks was reflected in interest by them in the progress of their son in the ship and in the navy. If the lad's interest faltered those at home enlisted themselves on the side of the ship and of the division officer, to the end that overtime and desertions grew fewer in number. With this reduction in offenses of this nature there resulted a smaller "turn over of labor"—fewer vacancies called for fewer recruits, fewer recruits meant a greater percentage of trained men on hand for battle practice.

As a conspicuous example of the spirit of the unit in a whole ship's company it is a pleasure to refer to one of our dreadnoughts in which every division had in its compartment a Christmas tree. When the ship was in a home port for the holiday season needy children were brought on board for Christmas dinner, after which each was presented with a suitable toy and an outfit of warm winter clothing. When in a foreign port during the war the same custom was observed, the children being collected from that port.

There was here the additional virtue of personal sacrifice on the part of all hands, for the number of children served and the excellent quality of the gifts were such as to involve no small subscriptions. Personal sacrifice is of the essence of life in the service; wherefore the benefit to be derived from this self-denial.

Here was a spirit of the unit. Here was leadership.

With the signs, and the spirit, and the worthy example, practiced by the leader and by his men, the unit attains to usefulness. Individuals observe the rules because of their appeal to the spirit. Finding their own interests alive in the mind of the leader, men's minds are to no small extent relieved of anxieties, real or fancied, and are to that extent the more free to concentrate on the mission of the unit. They become *for* the unit. They have found places in it. They lend a hand. They are members of the team. Their own success and that of the unit merge.

In a paper on leadership of men it is pertinent to quote from the pen of one whose leadership stands out with a record of achievement. In this paper short quotations have been made from John Paul Jones' letter of 14 September, 1775, to the Naval Committee of Congress. That letter gives so complete and so concise a statement of the requirements of a leader that additional quotations are here ventured.

Writing of the desired attributes of an officer of the navy, the illustrious sea-fighter says:

> He should not be blind to a single fault in any subordinate, though at the same time he should be quick and unfailing to distinguish error from malice, thoughtlessness from incompetence, and well-meant shortcoming from blunder. As he should be universal and impartial in his rewards and approval of merit, so should he be judicial and unbending in his punishment or reproof of misconduct.

Again:

> He should ever maintain the attitude of the commander [leader]; but that need by no means prevent him from the amenities of good cheer within proper limits.

Still again:

> In his relation to those under his command, he should be the soul of tact, patience, justice, firmness and charity.

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SLIDE RULES FOR NAVIGATORS

By CAPTAIN ARMISTEAD RUST, U. S. Navy.

In a paper entitled "General Solutions of the Problems of 'The Reduction to the Prime Vertical and to the Meridian,' with a New Graphic Method for the Solution of Various Problems in Navigation," which appeared in the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, Whole No. 151, May–June, 1914, the writer indicated how certain problems in nautical astronomy might be solved with slide rules.

These slide rules are shown on Plate II which accompanies this paper and with them all of the ordinary problems of astronomical navigation may be solved, including the "Time Sight" and the "Marcq Saint-Hilaire Method."

ABBREVIATIONS AND SYMBOLS

A = point of departure in $G.\ C.$ sailing; B = destination.
C = course; C_1, C_2 = initial and final courses in great circle sailing.
d = declination of observed body.
$D = AB = G.\ C.\ D.$ = great circle distance from A to B.
$D_A = G.\ C.\ D.$ from A to vertex V; $D_B = G.\ C.\ D.$ from B to vertex V.
Δh = difference between true altitude off the meridian and meridian altitude, or the "Reduction to the Meridian."
h = true altitude of center of observed body.
h_0 = meridian altitude of observed body.
h_v = altitude on the prime vertical.
L = latitude of ship or observer.
L_1 = latitude of departure in $G.\ C.$ sailing.
L_2 = latitude of ship destination in $G.\ C.$ sailing.
L_v = latitude of vertex in $G.\ C.$ sailing.
$G.\ A.\ T.$, $G.\ M.\ T.$, $G.\ S.\ T.$ = Greenwich apparent, mean and sidereal times.
$L.\ A.\ T.$, $L.\ M.\ T.$, $L.\ S.\ T.$ = local apparent, mean and sidereal times.

$M.Z.D.$ = meridian zenith distance of observed body $= z_0 = 90° - h_0$.
p = polar distance of observed body $= 90° \mp d$.
$P.V.$ = prime vertical.
$R.A.$ = right ascension; $R.A.M.S.$ = right ascension of mean sun.
t = local hour angle of observed body $= H.A.$
t_0 = hour angle on prime vertical.
V = vertex of great circle track.
z = zenith distance of observed body $= 90° - h$.
z_0 = meridian zenith distance $= L \mp d = 90° - h_0$.
Z = true azimuth of observed body.
λ = difference of longitude between A and B in $G.C.$ sailing.
λ_A = difference of longitude between A and vertex V.
λ_B = difference of longitude between B and vertex V.
λ_1 = longitude of point of departure A in $G.C.$ sailing.
λ_2 = longitude of point of destination B in $G.C.$ sailing.
α (alpha), β (beta), Δ (delta), λ (lambda), θ (theta) = Greek letters to indicate auxiliary angles.
$a > b$ means a is greater than b; $c < d$ means c is less than d.
$L \sim d$ means $L - d$ or $d - L$ according to whether $L > d$ or $d > L$.

In the formulas used in explaining the use of the slide rules, which are given in the various problems, the letter in parentheses which follow any quantity indicates the scale on which that quantity is to be used.

RULES I AND V

These are the same, except Rule V has been made to a much larger scale and therefore its range is limited.

PROBLEM 1.—Find the azimuth of a celestial body, given its hour-angle, declination and true altitude.

$$\sin t\ (A) \cos d\ (B) = \cos h\ (C) \sin Z\ (D). \qquad (1)$$

Set d on scale B to t on scale A, then opposite h on scale C find the azimuth Z on scale D.

NAMING THE AZIMUTH

1. Mark the azimuth E. or W. according to whether the observed body is east or west of the meridian of the observer.

2. When $L = 0°$ give the azimuth the same name as the declination.

3. When the latitude and the declination are of the same name and the latitude is less than the declination, the azimuth has the same name.

4. When the latitude and the declination are of contrary names, the azimuth has the name of the declination.

5. When the latitude and the declination have the same name, and the declination is less than the latitude, the body will cross the prime vertical. When it is between the P. V. and the elevated pole, that is, when its hour-angle is greater than the hour-angle on the P. V., the azimuth will have the same name as the latitude. When the body is between the P. V. and the equator, that is, when its hour-angle is less than t_v, the hour-angle on the P. V., the azimuth will have the contrary name to the latitude.

The hour-angle on the P. V. may be found with Rule II as shown below.

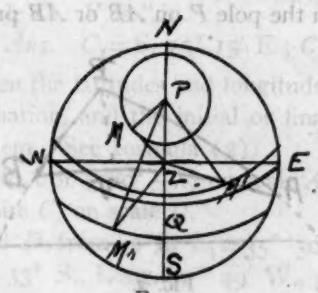


FIG. 1.

The reasons for the above rules will be seen from an examination of Fig. 1, which shows the celestial sphere projected on the plane of the horizon. M, M', M'' are the positions of three bodies.

By naming the azimuths in this way we avoid the use of angles greater than 90°.

Example 1.—$L=0°$; $t=4^h\ 30^m$ (west); $d=28°$ N.; $h=20°$. Find Z. *Ans.* N. 60° 12′ W.

Example 2.—$L=19°$ N.; $t=4^h\ 18^m$ (east); $d=29°$ N.; $h=31°$. Find Z. *Ans.* N. 67° 4′ E

Example 3.—$L=25°$ S.; $t=3^h\ 20^m$ (east); $d=28°$ N.; $h=19°$. Find Z. *Ans.* N. 45° 38′ E.

Example 4.—$L=48°$ N.; $t=5^h\ 55^m$ (west); $d=28°$ N.; $h=21°$. Find Z. *Ans.* N. 71° W.

Here $t_v=4^h\ 6^m$ and as $t>t_v$, Z has the same name as L.

Example 5.—$L=45°$ S.; $t=3^h\ 10^m$ (east); $d=26°$ S.; $h=48°$. Find Z. *Ans.* N. 83° E.

Here $t_v=4^h\ 3^m$ and, as $t<t_v$, Z has the contrary name.

PROBLEM 2.—Given the latitudes of the points of departure and destination L_1 and L_2, the G. C. D. between them D, and their difference of longitude λ, find the initial and final G. C. courses C_1 and C_2.

$$\sin\lambda(A)\cos L_2(B)=\cos(90°\sim D)\,(C)\sin C_1(D). \qquad (2)$$

Set L_2 on scale B to λ or $(180°-\lambda)$ on scale A; then opposite $(90°\sim D)$ on scale C, find C_1 on scale D. To find C_2 proceed as above, using L_1 in place of L_2.

NAMING THE COURSES

The vertex V of the G. C. track AB is the foot of a perpendicular let fall from the pole P on AB or AB produced, and is the

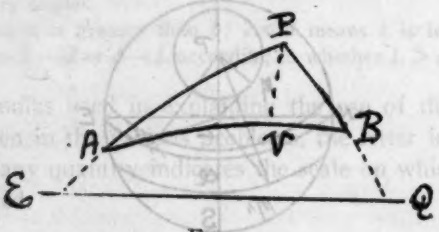


FIG. 2.

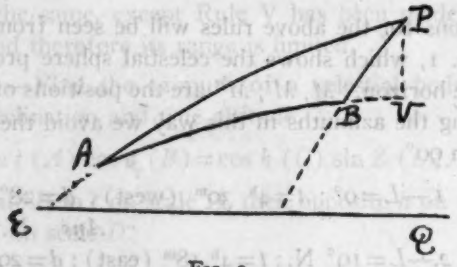


FIG. 3.

point of highest latitude. When V falls between A and B, C_1 and C_2 are each less than 90° (Fig. 2); when V falls beyond A or B, or on AB produced, as in Fig. 3, and $L_2>L_1$, then $C_1<90°$ and $C_2>90°$, when reckoned from the elevated pole P; or in this case C_2 read from scale D is given the contrary name to the latitude, or its supplement is given the same name. In all cases mark the course E. or W. according to the direction in which the ship is going.

NOTE.—In order to determine, when in doubt, whether V falls within or without the triangle APB, find C_3 and C_4 with Rule IV. When both are less than 90°, reckoned from the same pole, V is "in"; when one is greater and the other less than 90°, V is "out," and nearer the point of greater latitude.

Example 6.—Find the initial and final courses from A, $L_1=35°$ N., to B, $L_2=36°$ N., the difference of longitude $\lambda=70°\ 30'$, and $D=3360$ miles; B being east of A. Here $90°-D=34°$ and V is "in." *Ans.* $C_1=$N. 66° 50′ E.; $C_2=$S. 68° 40′ E.

Example 7.—Find C_1 and C_2 from A in $L_1=33°$ S., Long. 151° 50′ E., to B in $L_2=9°$ N., Long. 79° 30′ W.; $D=7620$ miles$=127°$. As $\lambda=128°\ 40'$, use $180°-\lambda=51°\ 20'$ on scale A, and $D-90°=37°$ on scale C. V is "in."

Ans. $C_1=$S. 75° 15′ E.; $C_2=$N. 55° 5′ E.

PROBLEM 3.—Given the latitudes and longitudes of the points of departure and destination, and the initial or final course, find the G. C. D. between them. See formula (2).

Set L_2 on scale B to λ or $(180°-\lambda)$ on scale A, and find $(90°\sim D)$ on scale C opposite C_1 on scale D.

Example 8.—Find D from A in $L_1=35°\ 30'$ N., Long. 140° 52′ E., to B in $L_2=33°$ S., Long. 71° 49′ W., given $C_1=$N. 94° 18′ E. *Ans.* $D=9180$ miles.

When C and λ are greater than 90° use their supplements.

Any formula deduced by Napier's Second Rule may be solved with Rule I or V.

PROBLEM 4.—Given the latitude of departure or destination and the initial or final course, find the latitude of the vertex.

$$\sin C_1(A)\cos L_1(B)=\cos L_v(C)\sin 90°(D), \quad (3)$$

$$\sin C_2(A)\cos L_2(B)=\cos L_v(C)\sin 90°(D). \quad (4)$$

Set L_1 on scale B to C_1 on scale A and find L_v on scale C opposite 90° on scale D.

Example 9.—Given $L_1=35°$ N., and $C_1=$N. 66° 50′ E. Find L_v. *Ans.* $L_v=41°\ 10'$ N.

Example 10.—Given $L_1=37°\ 50'$ S., $C_1=$S. 47° E. Find L_v.

Ans. $L_v=54°\ 42'$ S.

PROBLEM 5.—Given the latitudes of the points of departure and destination and the latitude of the vertex, find the distances from these points to the vertex and the total distance.

$$\sin 90°(A)\cos(90°-L_1)(B)=\cos D_A(C)\sin L_v(D). \quad (5)$$

Set $(90° - L_1)$ on scale B to 90° on scale A and find D_A on scale C opposite L_v on scale D. Find D_B by using L_2 in place of L_1 in (5).

Example 11.—$L_1 = 35°$ N., $L_2 = 36°$ N. and $L_v = 41°$ 10′ N. Find D_A, D_B and D.

Ans. $D_A = 29°$ 30′, $D_B = 26°$ 50′ and $D = 3380$ miles.

PROBLEM 6.—Given the hour-angle of a body on the prime vertical, its declination and the latitude of the observer, find its altitude on the prime vertical.

$$\sin t_v(A) \cos d(B) = \cos h_v(C) \sin 90°(D). \quad (6)$$

Set d on scale B to t_v on scale A and find h_v on scale C opposite 90° on scale D.

Example 12.—$L = 50°$ N.; $d = 28°$ N., and $t_v = 4^h\ 14^m$. Find h_v.

Ans. 37° 47′.

NOTE ON RULES I AND V.—Scale A should have been laid off in hours and minutes. Due to oversight the scale of degrees was inserted and it was necessary to place the scale of hours and minutes above this, as no time was available to make new drawings. As Rules I and V now stand scales C and D are not necessary, but they are useful in that they simplify the instructions for using the Rules.

RULE II

Any formula deduced by Napier's First Rule may be solved with Rule II, thus in all cases problems involving right spherical triangles may be solved with either Rule I or Rule II.

PROBLEM 7.—Find the hour-angle of a celestial body when on the prime vertical, given its declination and the latitude of the observer.

$$\tan d(E) \cot L(F) = \cos t_v(G) \times 1(H). \quad (7)$$

Set L on scale F to d on scale E and find t_v on scale G opposite the mark X on scale H.

Example 13.—$L = 50°$ N.; $d = 28°$ N. Find t_v.

Ans. $4^h\ 14^m$.

PROBLEM 8.—Given the latitudes of departure and destination, and the latitude of the vertex, find the longitudes of the vertex from the points of departure and destination.

$$\tan L_1(E) \cot L_v(F) = \cos \lambda_A(G) \times 1(H), \quad (8)$$

$$\tan L_2(E) \cot L_v(F) = \cos \lambda_B(G) \times 1(H). \quad (9)$$

Set L_v on scale F to L_1 on scale E and find λ_A on scale G opposite X on scale H.

Example 14.—$L_1 = 35°$ N.; $L_2 = 36°$ N. and $L_v = 41°$ 10′ N. Find λ_A and λ_B. *Ans.* $\lambda_A = 36°\ 45$; $\lambda_B = 33°\ 45'$.

PROBLEM 9.—Given the latitude of the vertex and the longitudes from the vertex to the points of departure and destination, find the distances from the vertex to these points and the total distance along the G. C. track.

$$\tan D_A(E) \cot \lambda_A(F) = \cos L_v(G) \times 1(H). \qquad (10)$$

Set L_v on scale G to the mark X on scale H and find D_A on scale E opposite λ_A on scale F. Find D_B by using λ_B for λ_A.

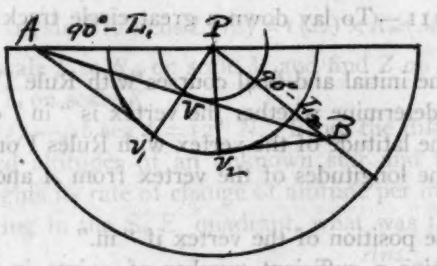


FIG. 4.

Example 15.—$L_v = 41°$ 10′ N.; $\lambda_A = 36°\ 45'$; $\lambda_B = 33°\ 45'$. Find D_A, D_B and D.

Ans. $D_A = 29°\ 23'$; $D_B = 26°\ 45'$; $D = 3368$ miles.

PROBLEM 10.—Composite sailing.

Example 16.—Find the distance along the composite track from A in $L_1 = 23°$ S., Long. 43° W., to B in $L_2 = 34°$ S., Long. 115° E., with the limiting parallel 55° S. Find also the initial and final courses along this track.

Fig. 4 shows the track projected on the plane of the equator.

(a) Find the distances $Av_1 = D_A$ and $Bv_2 = D_B$.

$$\sin L_{v_1}(A) \cos D_A(B) = \cos(90° - L_1)(C) \sin 90°(D). \qquad (11)$$

Set $(90° - L_1)$ on scale C to 90° on scale D and find D_A on scale B opposite L_{v_1} on scale A. Find D_B by using L_2 in place of L_1 in (11). We find $D_A = 61°\ 32'$ and $D_B = 46°\ 57'$.

(b) Find the differences of longitude $APv_1 = \lambda_A$ and $BPv_2 = \lambda_B$. We have

$$\tan L_1(E) \cot L_{v_1}(F) = \cos \lambda_A(G) \times 1(H). \qquad (12)$$

Set L_{v_1} on scale F to L_1 on scale E and find λ_A on scale G opposite X on scale H. Thus, $\lambda_A = 72° 45'$ and $\lambda_B = 61° 50'$. $\lambda_A + \lambda_B = 134° 35'$, and $APB = 158°$. Hence, $v_1Pv_2 = 23° 25' = 1405'$. From Traverse Tables we find departure parallel $55° = 800$ miles, hence total distance $D_A + D_B + 800 = 7309$ miles. The G. C. D. from A to $B = 7153$ miles and the distance lost is 152 miles.

(c) Find the courses from A to v_1 and from B to v_2.

$$\sin PAv_1(A) \cos L_1(B) = \cos L_{v_1}(C) \sin 90°(D). \quad (13)$$

Here $L_{v_1} = L_{v_2} = 55°$. Set L_{v_1} on scale C to 90° on scale D and find PAv_1 on scale A opposite L_1 on scale B. We thus find $PAv_1 =$ S. 38° 27′ E. and $PBv_2 =$ S. 43° 40′ W.

PROBLEM 11.—To lay down a great circle track on a Mercator chart.

1. Find the initial and final courses with Rule IV, Problem 15.
2. These determine whether the vertex is "in" or "out."
3. Find the latitude of the vertex with Rules I or V, Problem 4.
4. Find the longitudes of the vertex from A and B, λ_A and λ_B, Rule II.
5. Plot the position of the vertex if "in."
6. Determine a sufficient number of points in the track with Rule II and draw a curve through them with a flexible batten or connect them by straight lines.

Points may be determined in the track by assuming latitudes ranging between those of departure and destination and that of the vertex, and finding the corresponding longitudes. Thus, if L_p be the latitude of any point in the G. C. track and λ_p be its corresponding longitude from the vertex, then for each value of L_p two points in the track are determined by $\pm\lambda_p$, as each parallel of latitude intersects the G. C. track in points whose longitudes from the vertex are equal. From (8), we have

$$\tan L_p(E) \cot L_v(F) = \cos \lambda_p(G) \times 1(H).$$

Set L_v on scale F to the assumed latitudes, taken in succession, on scale E and find the corresponding longitudes on scale G opposite the mark X on scale H.

If preferred the longitudes may be assumed and the corresponding latitudes found thus:

Set the longitudes in succession on scale G to the mark X on scale H, and find the corresponding latitudes on scale E, opposite L_v on scale F.

In order to shape a G. C. C. from time to time during a voyage, note that if the initial G. C. D. be known, or is computed, it will not be necessary to recompute it during the voyage, as a rule, as the distance to the destination may be found every time it is desired to change the course by deducting the total distance made good from the initial distance and thus obtain the data for using Rules I or V for obtaining a new G. C. C. as often as may be desired.

RULE III

PROBLEM 12.—Given the rate of change of altitude per minute R_m of a celestial body and the latitude of the observer, find the azimuth of the body.

$$15 \sin Z(J) \cos L(K) = 1(L) \times R_m(M). \qquad (14)$$

Set 1 on scale L to R_m on scale M and find Z on scale J opposite the latitude L on scale K.

Example 17.—At sea $L = 12°$ N. From the difference between two observed altitudes of an unknown star and the interval between the sights its rate of change of altitude per minute was 13.3′. The star being in the S. E. quadrant, what was the true bearing of the star? *Ans.* S. 64° 45′ E.

THE REDUCTION TO THE MERIDIAN BY THE MEAN AZIMUTH METHOD

This method was fully demonstrated by the writer in the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, Whole No. 151, May–June, 1914.

PROBLEM 13.—Given the latitude by D. R., the true altitude, hour-angle and bearing or azimuth of a known celestial body, find the "reduction Δh" of this altitude to the meridian altitude and thence the latitude of the observer.

$$15 \sin \tfrac{1}{2}Z(J) \cos L(K) = t(L) \times \Delta h(M). \qquad (15)$$

Set the latitude by D. R., L, to $\frac{1}{2}Z$ on scale J and find the reduction to the meridian Δh in minutes of arc, on scale M opposite t, expressed in minutes and decimals of time on scale L.

NOTE.—If $\frac{1}{2}Z$ is less than 3° 49′, use Z on scale J and divide the number found on scale M by 2 to obtain Δh.

When $t > 10$, use $\frac{t}{n}$ on scale L, where n is any convenient factor, usually 10, and multiply the quantity found on scale M by n.

Example 18.—$L=34°\ 15°$ N.; $d=0°$; $t=40$ minutes; $h=54°\ 43'\ 36''$. Find $\frac{1}{2}Z$, Δh and the correct latitude.

Ans. $\frac{1}{2}Z=8°\ 52'$; $\Delta h=1°\ 16.6'$; $L=33°\ 59.8'$ N.

NOTE.—When the hour-angle is less than 60 minutes the bearing of the body is very nearly directly proportional to the hour-angle. Therefore in such a case find the azimuth Z' for one hour with Rule I, and if n be the number of minutes in the given hour-angle, the required azimuth $Z=\frac{n}{60}\times Z'$. In this way obtain $\frac{1}{2}Z=8°\ 52'$ in the above example.

When $t<60$ min. the azimuth may also be found by Plate I.

Example 19.—$L=36°\ 15'$ N. by D. R.; $d=17°$ S.; $t=60$ min.; $h=34°\ 39'$. Find $\frac{1}{2}Z$, Δh and the correct latitude.

Ans. $\frac{1}{2}Z=8°\ 45'$; $\Delta h=110.3'$; $L=36°\ 30.7'$ N.

Example 20.—In $L=38°\ 15'$ N. by D. R. The true altitude of λ Draconis, near the lower transit, was $18°\ 50'\ 42''$, star's hour-angle=60 minutes and declination $69°\ 47'$. Find Z, Δh and the latitude.

Ans. $Z=5°\ 30'$; $\Delta h=33.7'$; $L=38°\ 30'$ N.

NOTE.—Here Z does not fall within the limits of Rule I, but it may be found from Plate I or the formula $\sin Z=\sin t\cos d\sec h$.

RULE IV

PROBLEM 14.—The time-azimuth. Given the latitude of the observer and the hour-angle and declination of a celestial body, to find its azimuth.

$$\cot\tfrac{1}{2}t\cos\tfrac{1}{2}(L\sim d)=\cos\{90°-\tfrac{1}{2}(L+d)\}\tan\tfrac{1}{2}(Z+M), \quad (16)$$

$$\cot\tfrac{1}{2}t\cos\{90°-\tfrac{1}{2}(L\sim d)\}=\cos\tfrac{1}{2}(L+d)\tan\tfrac{1}{2}(Z\sim M). \quad (17)$$

(1) Set $\frac{1}{2}(L\sim d)$ on scale P to $\frac{1}{2}t$ on scale N and find the angle X on scale R opposite $90°-\frac{1}{2}(L+d)$ on scale Q.

(2) Set $90°-\frac{1}{2}(L\sim d)$ on scale P to $\frac{1}{2}t$ on scale N and find the angle Y on scale R opposite $\frac{1}{2}(L+d)$ on scale Q.

(3) When $L>d$: $Z=X+Y$. When $L<d$: $Z=X\sim Y$; L and d being of the same name.

(4) Give the azimuth the same name as the latitude of the observer and mark it E. or W. according to whether the body is east or west of his meridian.

(5) Mark the latitude of the observer $+$, and the declination when of the same name $+$, when of contrary name $-$.

(6) In (1) when $d>L$ and of the contrary name, use $90°-\frac{1}{2}(d-L)$ on scale Q, and X is the supplement of the angle X' found on scale R.

(7) When L and d are of contrary names $Z=X+Y$ in all cases.

(8) When L and d are of contrary names $(L\sim d)$ and $(L+d)$ in (1) and (2), become $(L+d)$ and $(L\sim d)$, respectively.

Example 21.—$L=38°$ N.; $d=16°$ N.; $t=3^h\ 40^m$ (west). Find Z.

(a)	$\frac{1}{2}t=1^h\ 50^m$	(a)	$\frac{1}{2}t=1^h\ 50^m$
X (b)	$\frac{1}{2}(L-d)=11°$	Y (d)	$90°-\frac{1}{2}(L-d)=79°$
(c)	$90°-\frac{1}{2}(L+d)=63°$	(e)	$\frac{1}{2}(L+d)=27°$
	$X=76°\ 25'$		$Y=22°\ 30'$

As $L>d$, $Z=X+Y=98°\ 55'$.

Ans. $Z=$N. $98°\ 55'$ W.

Note that in the groups for finding X and Y, (a) is the same in both, and (d) and (e) are the complements of (b) and (c) respectively.

Example 22.—$L=39°$ S.; $d=17°$ N.; $t=4^h\ 20^m$ (east). Find Z.

Ans. $Z=$S. $119°\ 7'$ E.

(a)	$\frac{1}{2}t=2^h\ 10^m$	(a)	$\frac{1}{2}t=2^h\ 10^m$
X (b)	$\frac{1}{2}(L+d)=28°$	Y (d)	$90°-\frac{1}{2}(L+d)=62°$
(c)	$90°-\frac{1}{2}(L-d)=79°$	(e)	$\frac{1}{2}(L-d)=11°$
	$X=82°\ 7'$		$Y=37°$

$$Z=X+Y=119°\ 7'.$$

Example 23.—$L=10°$ N.; $d=22°$ S.; $t=4^h.30^m$ (west). Find Z.

Ans. $Z=$N. $116°\ 43'$ W.

(a)	$\frac{1}{2}t=2^h\ 15^m$	(a)	$\frac{1}{2}t=2^h\ 15^m$
X' (b)	$\frac{1}{2}(L+d)=16°$	Y (d)	$90°-\frac{1}{2}(L+d)=74°$
(c)	$90°-\frac{1}{2}(d-L)=84°$	(e)	$\frac{1}{2}(d-L)=6°$
$X'=85°\ 52'$;	$X=180°-X'=94°\ 8'$		$Y=22°\ 35'$

$$Z=X+Y=116°\ 43'.$$

GREAT CIRCLE COURSES AND DISTANCES

PROBLEM 15.—Given the latitudes and longitudes of the points of departure and destination to find the initial and final great circle courses and distance.

$$\cot\tfrac{1}{2}\lambda\cos\tfrac{1}{2}(L_1\sim L_2)=\cos\{90°-\tfrac{1}{2}(L_1+L_2)\}\tan\tfrac{1}{2}(C_1+C_2), \quad (18)$$

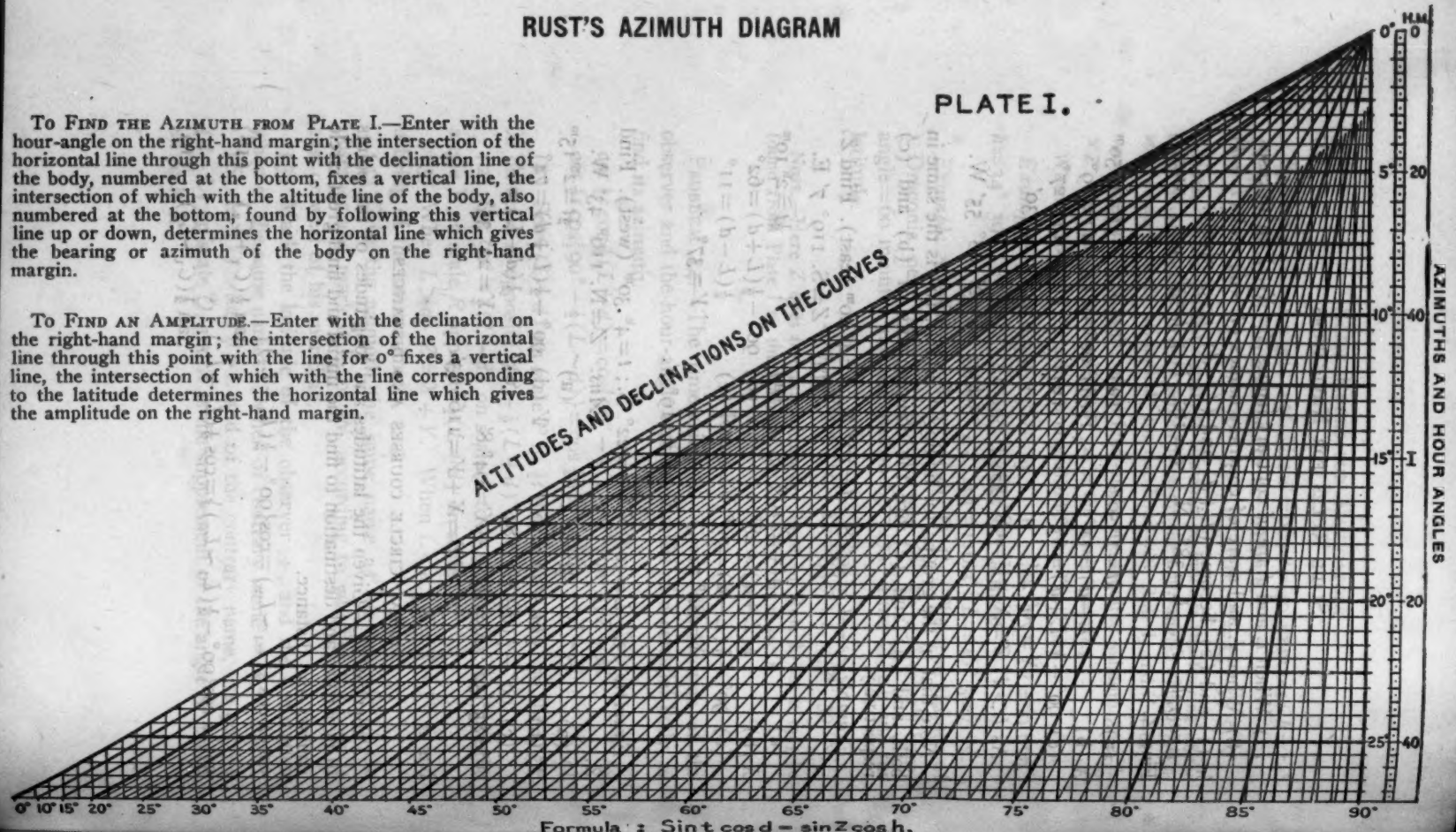
$$\cot\tfrac{1}{2}\lambda\cos\{90°-\tfrac{1}{2}(L_1\sim L_2)\}=\cos\tfrac{1}{2}(L_1+L_2)\tan\tfrac{1}{2}(C_1\sim C_2). \quad (19)$$

RUST'S AZIMUTH DIAGRAM

PLATE I.

To Find the Azimuth from Plate I.—Enter with the hour-angle on the right-hand margin; the intersection of the horizontal line through this point with the declination line of the body, numbered at the bottom, fixes a vertical line, the intersection of which with the altitude line of the body, also numbered at the bottom, found by following this vertical line up or down, determines the horizontal line which gives the bearing or azimuth of the body on the right-hand margin.

To Find an Amplitude.—Enter with the declination on the right-hand margin; the intersection of the horizontal line through this point with the line for 0° fixes a vertical line, the intersection of which with the line corresponding to the latitude determines the horizontal line which gives the amplitude on the right-hand margin.



(1) Set $\frac{1}{2}(L_1 \sim L_2)$ on scale P to $\frac{1}{2}\lambda$ on scale N and find the angle X on scale R opposite $90° - \frac{1}{2}(L_1 + L_2)$ on scale Q.

(2) Set $90° - \frac{1}{2}(L_1 \sim L_2)$ on scale P to $\frac{1}{2}\lambda$ on scale N and find the angle Y on scale R opposite $\frac{1}{2}(L_1 + L_2)$ on scale Q.

(3) L_1 and L_2 being of the same name:

When $L_1 > L_2$: $C_1 = X + Y$ and $C_2 = X \sim Y$.

When $L_1 < L_2$: $C_1 = X \sim Y$ and $C_2 = X + Y$.

(4) Give C_1 the same name as L_1 and mark it E. or W. to correspond to the direction of the ship.

(5) When V is "in," give C_2 the contrary name to L_1 and mark it E. or W. like C_1, when V is "out," give C_2 the same name as L_1.

(6) In formulas (18) and (19) mark L_1 and L_2+ when of the same name; otherwise mark L_2-.

(7) In (1) when $L_2 > L_1$ and of the contrary name, use $90° - \frac{1}{2}(L_2 - L_1)$ on scale Q, and X is the supplement of the angle X' found on scale R.

(8) When L_1 and L_2 are of contrary names, $C_1 = X + Y$ and $C_2 = X \sim Y$ in all cases.

(9) To find the great circle distance. When L_1 and L_2 are of the same name, set X on scale P to $\frac{1}{2}(L_1 + L_2)$ on scale N and find $\frac{1}{2}D$ on scale R opposite Y on scale Q. If L_1 and L_2 are of contrary names use $\frac{1}{2}(L_1 \sim L_2)$ in place of $\frac{1}{2}(L_1 + L_2)$. When $X > 90°$, use $180° - X$, or X'.

(10) When L_1 and L_2 are of contrary names, $(L_1 \sim L_2)$ and $(L_1 + L_2)$ in (1) and (2) become $(L_1 + L_2)$ and $(L_1 \sim L_2)$, respectively.

Example 24.—Find the initial and final courses from A in $L_1 = 51°\ 26'$ N., Long. $9°\ 29'$ W., to B in $L_2 = 46°\ 39'$ N., Long. $53°\ 4'$ W. *Ans.* $C_1 =$ N. $82°\ 7'$ W.; $C_2 =$ S. $64°\ 7'$ W.

(a) $\frac{1}{2}\lambda = 21°\ 47'$ (a) $\frac{1}{2}\lambda = 21°\ 47'$

X (b) $\frac{1}{2}(L_1 - L_2) = 2°\ 23'$ Y (d) $90° - \frac{1}{2}(L_1 - L_2) = 87°\ 37'$

(c) $90° - \frac{1}{2}(L_1 + L_2) = 40°\ 57'$ (e) $\frac{1}{2}(L_1 + L_2) = 49°\ 03'$

$X = 73°\ 7'$ $Y = 9°$

$C_1 = X + Y = 82°\ 7'$ and $C_2 = X - Y = 64°\ 7'$.

Example 25.—Find C_1, C_2 and D from A in $L_1 = 6°\ 2'$ N., Long. $80°\ 13'$ E., to B in $L_2 = 35°\ 2'$ S., Long. $117°\ 54'$ E.

Ans. $C_1 =$ N. $141°\ 56'$ E.; $C_2 =$ S. $48°\ 26'$ E.; $D = 3254$ miles.

	(a)	$\frac{1}{2}\lambda = 18° 50'$		(a)	$\frac{1}{2}\lambda = 18° 50'$
X'	(b)	$\frac{1}{2}(L_1+L_2) = 20° 32'$	Y	(d)	$90° - \frac{1}{2}(L_1+L_2) = 69° 28'$
	(c)	$90° - \frac{1}{2}(L_2-L_1) = 75° 30'$		(e)	$\frac{1}{2}(L_2-L_1) = 14° 30'$

$X' = 84° 49'$; $X = 180° - X' = 95° 11'$; $Y = 46° 45'$;

$C_1 = X + Y = 141° 56'$; $C_2 = X - Y = 48° 26'$.

From (9), $D = 3254$ miles.

THE IDENTIFICATION OF STARS

PROBLEM 16.—Given the true altitude and azimuth of an unknown star, reckoned from the elevated pole, and the latitude of the observer to find the hour-angle and declination of the star.

$$\cot \tfrac{1}{2}Z \cos \tfrac{1}{2}(L \sim h) = \cos\{90° - \tfrac{1}{2}(L+h)\} \tan \tfrac{1}{2}(t+M), \quad (20)$$

$$\cot \tfrac{1}{2}Z \cos\{90° - \tfrac{1}{2}(L \sim h)\} = \cos \tfrac{1}{2}(L+h) \tan \tfrac{1}{2}(t \sim M). \quad (21)$$

(1) Set $\frac{1}{2}(L \sim h)$ on scale P to $\frac{1}{2}Z$ on scale N and find the angle X on scale R opposite $90° - \frac{1}{2}(L+h)$ on scale Q.

(2) Set $90° - \frac{1}{2}(L \sim h)$ on scale P to $\frac{1}{2}Z$ on scale N and find the angle Y on scale R opposite $\frac{1}{2}(L+h)$ on scale Q.

(3) When $L > h$, $t = X + Y$ and $M = X \sim Y$. When $L < h$, $t = X \sim Y$ and $M = X + Y$.

(4) When the body is west of the observer's meridian mark the hour-angle t, + when east, mark $t-$. Consider both L and $h+$ in the above formulas, (20) and (21).

(5) To find the declination of the star. Set X on scale P to $\frac{1}{2}(L+h)$ on scale N and find $\frac{1}{2}p$ on scale R opposite Y on scale Q. When $X > 90°$, use $180° - X$, or X'. When $p > 90°$ then $d = p - 90°$, and is of the contrary name to L. When $p < 90°$, then $d = 90° - p$, and is of the same name as L.

Example 26.—At sea, February 26, 1901, 6.30 p. m., L. M. T. Weather overcast and cloudy. The altitude of an unknown star observed through a rift in the clouds was 29° 30′ (true) bearing N. 74° W. Lat. by D. R. 35° N.; Long. 60° W. Find the hour-angle of the star.

	(a)	$\frac{1}{2}Z = 37° 00'$		(a)	$\frac{1}{2}Z = 37° 00'$
X	(b)	$\frac{1}{2}(L-h) = 2° 45'$	Y	(d)	$90° - \frac{1}{2}(L-h) = 87° 15'$
	(c)	$90° - \frac{1}{2}(L+h) = 57° 45'$		(e)	$\frac{1}{2}(L+h) = 32° 15'$
		$X = 68°$			$Y = 4° 18'$

As $L > h$, $t = X + Y = 72° 18' = 4^h 49^m 12^s$ (west).

From (5), $p = 62°$ and $d = 28°$ and is marked N. because $p < 90°$.

PROBLEM 17.—Given the latitude and longitude of the observer, the hour-angle and altitude of an unknown star, and the time of observation to find its right ascension and declination, with Rule I.

(1) When the star is east of the observer's meridian add its hour-angle to the L. S. T. to obtain the R. A. of the star; when west subtract it from the L. S. T.

(2) Set h on scale C to Z on scale D and find d on scale B opposite t on scale A. (Use Rule I or V.)

NAMING THE DECLINATION

There will be no difficulty in determining the name of the declination except when the declination is small, or when the star is near the equator. In all cases the sign of the declination may be readily determined by Table I, for which the writer is indebted to Commander H. L. Rice, U. S. Navy.

TABLE I—VALUES OF Q

Altitudes	For azimuths North toward West or North toward East										Altitudes
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
°	°	°	°	°	°	°	°	°	°	°	°
10	16.0	16.0	15.9	15.7	15.4	14.9	14.1	12.5	8.9	0.0	10
20	14.0	13.9	13.8	13.4	12.9	12 2	10.8	8.6	5.1	0.0	20
30	12.0	11.9	11.7	11.3	10.6	9.6	8.2	6.1	3.3	0.0	30
40	10.0	9.9	9.6	9.2	8.5	7.5	6.2	4.4	2.3	0.0	40
50	8.0	7.9	7.7	7.2	6.5	5.7	4.6	3.2	1.7	0.0	50
60	6.0	5.9	5.7	5.3	4.8	4.1	3.2	2.2	1.1	0.0	60
70	4.0	3.9	3.8	3.5	3.1	2.6	2.1	1.4	0.7	0.0	70
80	2.0	2.0	1.9	1.7	1.5	1.3	1.0	0.7	0.4	0.0	80
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
Altitudes	For azimuths South toward West or South toward East										Altitudes

Express the latitude in degrees and tenths as Q in the table.
Mark north latitude + and south latitude —.
When the azimuth is found at the top of the table, Q is +.
When the azimuth is found at the bottom of the table, Q is —.
The declination has the sign of $Q + \frac{\text{latitude}}{5}$.

TO FIND THE DECLINATION

Example 27.—At sea, in Long. 60° W., February 26, 1901, the hour-angle of an unknown star was $4^h\ 49^m\ 12^s$, bearing N. 74° W.,

and its true altitude was 29° 30′. Find its R. A. and declination and the name of the star.

	h	m	s
L. M. T.	6	30	00
R. A. M. S.	22	22	33
Cor. G. M. T.		1	43
L. S. T.	4	54	16
Star's H. A.	4	49	12
Star's R. A.	0	05	04

By (2), Problem 17, we find $d=28°$ 35′, using Rule V, and by Table I d is found to be + or north.

Star's R. A. $0^h\ 05^m\ 04^s$

Star's Dec. 28° 35′ N.

These show the star observed was α Andromedæ.

RULE VI

PROBLEM 18.—The "time sight." Given the latitude of the observer, the true altitude and corrected declination of a celestial body, to find its hour-angle.

Add together the log secants of L and d taken from Table II. Set $s=\frac{1}{2}(h+L+p)$ on scale T to $(s-h)$ on scale S and find the hour-angle t on scale W opposite the sum of the log secants of L and d on scale V.

Example 28.—$h=48°\ 53'$; $L=30°\ 20.5'$ N.; $d=22°\ 0.8'$ N.

h	48°	53′
L	30	20.5
p	67	59.2
$2s$	147	12.7
s	73	36.3
h	48	53
$s-h$	24	43.3

$p=90°-d$

$=67°\ 59.2'$

$L=30°\ 20.5'$ log sec 0.0639

$d=22\ \ 00.8$ log sec 0.0329

Sum 0.0968

Following the directions given above, we find $t=3^h\ 00^m\ 38^s$.

PROBLEM 19.—The "altitude azimuth." Given the latitude of the observer and the true latitude and corrected declination of a celestial body, to find its azimuth.

Add together the log secants of L and h. Set $s=\frac{1}{2}(L+z\pm d)$ on scale T to $(s\mp d)$ on scale S and find Z on scale W opposite to (log sec L + log sec h) on scale V.

(1) The upper signs in the above expressions are used when L and d are of the same name and the lower when they are of contrary names.

TABLE II—LOG SECANTS AND COSECANTS

Enter at top for Secants. Minutes for Log Secants

Sec.	0′	10′	20′	30′	40′	50′		Sec	0′	10′	20′	30′	40′	50′		1′	2′	3′	4′	5′	6′	7′	8′	9′
0	0.0000	0000	0000	0000	0000	0000	89°	1°	0.0001	0001	0001	0002	0002	0002	88°	..	..	..	..	..	..	..	..	..
2	0.0003	0003	0004	0004	0005	0006	87	3	0.0006	0007	0007	0008	0009	0010	86	..	..	..	..	..	..	1	1	1
4	0.0011	0012	0012	0013	0014	0016	85	5	0.0017	0018	0019	0020	0021	0023	84	..	..	..	..	..	1	1	1	1
6	0 0024	0025	0027	0028	0030	0031	83	7	0 0033	0034	0036	0037	0039	0041	82	..	..	..	..	1	1	1	1	1
8	0.0042	0044	0046	0048	0050	0052	81	9	8.0054	0056	0058	0060	0062	0064	80	..	..	1	1	1	1	1	2	2
10	0.0066	0069	0071	0073	0076	0078	79	11	0.0080	0083	0085	0088	0091	0093	78	..	..	1	1	1	1	1	2	2
12	0.0096	0099	0101	0104	0107	0110	77	13	0.0113	0116	0119	0122	0125	0128	76	..	1	1	1	1	2	2	2	3
14	0.0131	0134	0137	0141	0144	0147	75	15	0.0151	0154	0157	0161	0164	0168	74	..	1	1	1	2	2	2	3	3
16	0.0172	0175	0179	0183	0186	0190	73	17	0.0194	0198	0202	0206	0210	0214	72	..	1	1	1	2	2	2	3	3
18	0.0218	0222	0226	0230	0235	0239	71	19	0.0243	0248	0252	0256	0261	0266	70	..	1	1	2	2	2	3	3	3
20	0.0270	0275	0279	0284	0289	0294	69	21	0.0298	0303	0308	0313	0318	0323	68	..	1	1	2	2	3	3	4	4
22	0.0328	0333	0339	0344	0349	0354	67	23	0.0360	0365	0371	0376	0381	0387	66	1	1	2	2	3	3	4	4	5
24	0.0393	0398	0404	0410	0416	0421	65	25	0.0427	0433	0439	0445	0451	0457	64	1	1	2	2	3	3	4	5	5
26	0.0463	0470	0476	0482	0488	0495	63	27	0.0501	0508	0514	0521	0527	0534	62	1	1	2	3	3	4	4	5	6
28	0.0541	0547	0554	0561	0568	0575	61	29	0.0582	0589	0596	0603	0610	0617	60	1	1	2	3	3	4	5	6	6
30	0.0625	0632	0639	0647	0654	0662	59	31	0.0669	0677	0685	0692	0700	0708	58	1	2	2	3	4	5	5	6	7
32	0.0716	0724	0732	0740	0748	0756	57	33	0 0764	0772	0781	0789	0797	0806	56	1	2	2	3	4	5	6	6	7
34	0.0814	0823	0831	0840	0849	0857	55	35	0.0866	0875	0884	0893	0902	0911	54	1	2	3	3	4	5	6	7	8
36	0.0920	0930	0939	0948	0958	0967	53	37	0.0976	0986	0996	1005	1015	1025	52	1	2	3	4	5	6	7	8	9
38	0.1035	1045	1054	1065	1075	1085	51	39	0.1095	1105	1116	1126	1136	1147	50	1	2	3	4	5	6	7	8	9
40	0.1157	1168	1179	1189	1200	1211	49	41	0.1222	1233	1244	1255	1267	1278	48	1	2	3	4	5	7	8	9	10
42	0.1289	1301	1312	1324	1335	1347	47	43	0.1359	1370	1382	1394	1406	1418	46	1	2	4	5	6	7	8	9	11
44	0 1431	1443	1455	1468	1480	1493	45	45	0.1505	1518	1531	1543	1556	1569	44	1	2	4	5	6	7	9	10	11
46	0.1582	1595	1609	1622	1635	1649	43	47	0.1662	1676	1689	1703	1717	1731	42	1	3	4	5	7	8	9	11	12
48	0.1745	1759	1773	1787	1802	1816	41	49	0.1831	1845	1860	1875	1889	1904	40	2	3	5	6	7	9	10	12	13
50	0.1919	1934	1950	1965	1980	1996	39	51	0.2011	2027	2043	2058	2074	2090	38	2	3	5	6	8	9	11	12	14
52	0.2107	2123	2139	2155	2172	2189	37	53	0.2205	2222	2239	2256	2273	2290	36	2	3	5	7	8	10	12	13	15
54	0.2308	2325	2343	2360	2378	2396	35	55	0.2414	2432	2450	2469	2487	2506	34	2	4	5	7	9	11	13	14	16
56	0.2524	2543	2562	2581	2600	2619	33	57	0.2639	2658	2678	2698	2718	2738	32	2	4	6	8	10	12	14	16	18
58	0.2758	2778	2799	2819	2840	2861	31	59	0.2882	2903	2924	2945	2967	2988	30	2	4	6	8	10	12	15	17	19
60	0.3010	3032	3054	3077	3099	3122	29	61	0.3144	3167	3190	3213	3237	3260	28	2	5	7	9	11	14	16	18	20
62	0.3284	3308	3332	3356	3380	3405	27	63	0.3429	3454	3479	3505	3530	3556	26	2	5	7	9	12	15	17	20	22
64	0.3582	3608	3634	3660	3687	3714	25	65	0.3741	3768	3795	3823	3851	3879	24	3	5	8	11	13	16	19	22	24
66	0.3907	3935	3964	3993	4022	4052	23	67	0.4081	4111	4141	4172	4202	4233	22	3	6	9	12	15	18	21	24	27
68	0.4264	4296	4327	4359	4392	4424	21	69	0.4457	4490	4523	4557	4591	4625	20	3	7	10	13	17	20	24	26	30
70	0.4660	4694	4730	4765	4801	4837	19	71	0.4874	4910	4948	4985	5023	5062	18	4	7	11	14	18	22	25	29	33
72	0.5100	5139	5179	5219	5259	5300	17	73	0.5341	5382	5424	5467	5510	5553	16	4	8	12	16	21	25	29	33	37
74	0.5597	5641	5686	5731	5777	5823	15	75	0.5870	5918	5965	6014	6063	6113	14	5	9	14	19	24	28	33	38	42
76	0.6163	6214	6266	6318	6371	6425	13	77	0.6479	6534	6590	6647	6704	6762	12	5	11	16	22	27	32	38	43	49
	60′	50′	40′	30′	20′	10′	Cosec		60′	50′	40′	30′	20′	10′	Cosec	1′	2′	3′	4′	5′	6′	7′	8′	9′

Minutes for Log Cosecants. Enter at bottom for Cosecants

Diffs. for minutes—Add

Diffs. for minutes—Subtract

(2) The azimuth is given the same name as the latitude of the observer and is marked E. when the body is east of the observer's meridian; otherwise W.

Example 29.—Lat. 21° 30′ N., Dec. 11° 30′ S., and altitude of the sun's center 30°. Find the azimuth, the sun being west of the meridian.

L	21° 30′ N.	$z=90°-h=60°$	$L=21°\ 30'$ log sec 0.0313
z	60 00		$h=30\ 00$ log sec 0.0625
	81 30		Sum 0.0938
d	11 00 S.		
$2s$	70 00	Following the directions given above, we	
s	35 00	find $Z=7^h\ 53^m=$N. 118° 15′ W.	
d	11 30 S.		
$s+d$	46 30		

PROBLEM 20. Given the latitudes of the points of departure and destination with the G. C. D. between them, to find the initial and final G. C. courses.

(1) To find the initial course:

Set $s=\frac{1}{2}(L_1+D\pm L_2)$ on scale T to $(s\mp L_2)$ on scale S and find C_1 on scale W opposite (log sec L_1+log cosec D) on scale V.

(2) To find the final course:

Set $s=\frac{1}{2}(L_1+D\pm L_2)$ on scale T to $(s\mp L_1)$ on scale S and find C_2 on scale W opposite (log sec L_2+log cosec D) on scale V.

In the above expressions use the upper signs when L_1 and L_2 have the same name and the lower signs when they have the contrary names.

Give C_1 and C_2 the names L_1 and L_2, respectively; C_2 is thus reckoned as an initial course, reverse its direction for the final course.

Example 30.—Find the initial and final courses from Wolf Rock, Lat. 49° 57′ N., Long. 5° 48′ W., to Charleston, S. C., Lat. 32° 45′ N., Long. 79° 52′ W.; G. C. D.=3346 miles=55° 46′.

L_1	49° 57′	log sec	0.1914
D	55 46	log cosec	0.0826
L_2	32 45	Sum	0.2740
$2s$	138 28		
s	69 14	Following the directions given above, we	
L_2	32 45	find $C_1=5^h\ 12^m\ 22^s=$N. 78° 5′ W.	
$s-L_2$	36 29		

L_2	32° 45′	log sec	0.0752
D	55 46	log cosec	0.0826
L_1	49 57	Sum	0.1578
$2s$	138 28		
s	69 14		
L_1	49 57		
$s-L_1$	19 17		

Following the directions given above, we find C_2=S. 48° 28′ W.

RULE VII

PROBLEM 21.—The "Marc Saint-Hilaire Method."

Given the longitude and latitude L of P, the assumed position of the ship, the true altitude of the observed body h, its hour-angle t, and declination d, to find the altitude difference A. D., and the sign of its application to the computed zenith distance z'.

(1) Set L on scale b to t on scale a and find θ on scale f opposite d on scale e.

(2) With θ on scale d find nat hav θ on scale c, take also nat hav $(L \mp d)$ from scale c. Nat hav θ + nat hav $(L \mp d)$ = nat hav z'.

(3) With nat hav z' on scale c find z' on scale d.

(4) $h'=90°-z'$ and A. D.$=h'-h$. When A. D. is + it is laid off along the line of azimuth *away* from the body, and when A. D. is − it must be laid off *towards* the body. We thus establish P', a point on the line of position though which a line is drawn at right angle to the line of azimuth.

Example 31.—At sea, Nov. 9, 1888, about 2.30 p. m. Lat. 34° 30′ N.; Long. 65° 40′ W. True altitude moon's center was 20° 11′ 36″, bearing to S'd and E'd; W. T. Obs. $2^h\ 28^m\ 54^s$; $C-W=4^h\ 14^m\ 5^s$; C. C.$-3^m\ 48^s$; moon's correct R. A. $20^h\ 37^m\ 33^s$; correct declination 19° 51′ S. Find the altitude difference A. D., and the bearing of the moon.

Here	t $3^h\ 3^m\ 35^s$ (east) (a)	$z'=69°\ 42'$	
	L 34° 30′ N. (b)	90	
	d 19° 51′ S. (e)	$h'=20\ 18$	
	θ 40° 10′ (f)	$h=20\ 11.6$	
nat hav θ	.1180 (c) (d)	A. D.$=+$ 6.4, *away* from	
nat hav$(L+d)$	.2086 (c) (d)	the moon.	
nat hav z'	.3266 (c) (d)		

With Rule I we find Z=N. 134° 10′ E., or the moon bears S. 45° 50′ E. The letters in parentheses indicate the scales to be used.

PROBLEM 22.—To find the great circle distance.

Given the latitudes L_1 and L_2 of A and B, the points of departure and destination, and the difference of longitude λ between their meridians. Find the great circle distance D from A to B.

(1) Set L_1 on scale b to λ on scale a and find α on scale f opposite L_2 on scale e.

(2) With α on scale d find nat hav α on scale c, also take nat hav $(L_1 \mp L_2)$ from scale c. Nat hav α + nat hav $(L_1 \mp L_2)$ = nat hav D.

(3) With nat hav D on scale c, find D on scale d.

Example 32.—

A: Lat. 32° 00′ S. B: Lat. 36° 00′ N.
Long. 165 45 E. Long. 123 00 W.

Find the great circle distance D.

Here λ 71° 15′ (a)
L_1 32° 15′ S. (b)
L_2 36° 00′ N. (e)
α 57° 42′ (f)
nat hav α 0.2325 (c) (d)
nat hav (L_1+L_2) 0.3126 (c) (d)
nat hav D 0.5451 (c) (d)
D 95° 12′ (c) (d)
5712 miles.

By following the directions given above we find D = 5712 miles.

PROBLEM 23.—Given the latitude L, the true altitude h, and azimuth Z, of an unknown star, to find its declination and hour-angle.

(1) Set L on scale b to Z (expressed in h, m and s) on scale a and find β on scale f opposite h on scale e.

(2) With β on scale d find nat hav β on scale c. Also take nat hav $(L \sim h)$ from scale c, nat hav β + nat hav $(L \sim h)$ = nat hav p.

(3) With nat hav p on scale c, find p on scale d.

(4) When $p < 90°$, d has the same name as the latitude, and $d = 90° - p$.

(5) When $p > 90°$, d has the contrary name to the latitude and $d = p - 90°$.

(6) Find the hour-angle with Rule I thus: Set h on scale C to Z on scale D and find t on scale A opposite d on scale B.

Example 33.—At sea, Lat. 11° 37′ N., Long. 81° 9′ W., about 5.30 a. m. The true altitude of an unknown star, seen through a

rift in the clouds, was 25° 55′, bearing N. 115° E. Find the declination, the hour-angle of the star and its name. G. S. T. of obr. $=8^h\ 12^m\ 17^s$.

Ans. $p=106°\ 37'$, hence $d=16°\ 37'$ S., $t=3^h\ 53^m\ 30^s$.

R.A $=6^h\ 41^m\ 11^s$, and the star is α Canis Majoris (Sirius).

DIRECTIONS FOR CONSTRUCTING THE SLIDE RULES

These should be mounted so that Rules I to V form one set and Rules VI and VII the other.

Paste the first set on good stiff cardboard, using good mucilage and not photo paste. Spread the mucilage on the cardboard with a good brush about 2″ wide, and place the print over it and rub down quickly and evenly, first very lightly lengthwise, then crosswise so as not to stretch the paper. Use a blotter or piece of paper between the print and cloth. Weight down the cardboard and let it dry.

With a safety-razor blade and a steel straight-edge or a carpenter's square to guide it, cut the inner scales *B, C, F, G,* etc., from the mounted print. Or if convenient have the mounted print cut into strips with a stationer's paper-cutting machine.

Provide sufficient cardboard of the same thickness and about 26″ wide, to have a base 8″ x 26″, on which to mount the scales, and to make covering pieces and filling pieces.

Assemble these various parts, as shown in Fig. 5, by laying the filling piece 2 in the position shown and make a mark along its inner edge with a sharp pencil. Spread mucilage evenly on the base 1, leaving a margin of $\frac{1}{8}$″ from line *p*. Put mucilage also on piece 2, leaving $\frac{1}{8}$″ margin from its inner edge. Place 2 on 1 and weight it down to set.

Next spread mucilage on top of 2 and on bottom of 3, leaving $\frac{1}{8}$″ margin from *n*. Place 3 on 2 and weight down to set. Next slip the slide 4 under 3 and move it back and forth to see that there is no excess of mucilage. Press 4 gently up against 2 and make a pencil line along the edges *m* and *q*. Remove 4 and spread mucilage evenly on the bottom of 5 and top of 4, leaving $\frac{1}{8}$″ margins at *m* and *q*. Place 5 carefully on 4, rub down, and place the slide in the position shown in the figure. Move it back and forth and see that the edges *A* and *B* coincide their full length. Mark the lines *r, s, t* and *u*. Put 6 in place and move the slide back and

forth. Then place 7 in position and press it gently against 5 until the edges *C* and *D* coincide throughout. Move the slide back and forth until it moves freely.

Weight with books and set aside to dry.

In the same way assemble Rules II, III, IV and V.

It is important that the outside scales *A* and *D* should be lined up exactly as shown on the print. This may be easily done by setting the slide to scale *A* as it was originally and lining scale *D* up by it. After the rules have been assembled on the base it should be glued, or secured with thumb tacks to a piece of $\frac{3}{4}$" board.

While it is intended to have these slide rules printed on cardboard, all of the examples in this paper under Rules I, II, III, IV and V were solved with a set of rules made as shown above. The

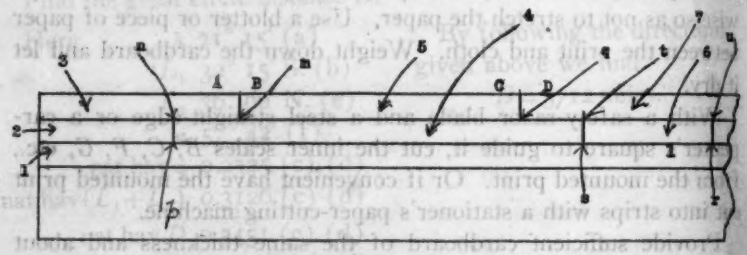


FIG. 5.

results compare favorably with those obtained by computation and are sufficiently accurate for practical navigation.

To obtain accurate results with Rules VI and VII, however, these should be printed on cardboard, as a slight uneven distortion of the paper when working to seconds of time will of course, materially affect the result.

If the rules be assembled as directed above, the navigator can, with the expenditure of a small amount of labor and care, make himself a set of slide rules which, for all practical purposes, will be just as good as though they had been made by an instrument maker at a cost that would in all probability put them far beyond his reach.

It would probably be better to make Rules VI and VII on discs so as to have the scales much longer without making the rules unwieldly. The writer hopes to accomplish this at some future time.

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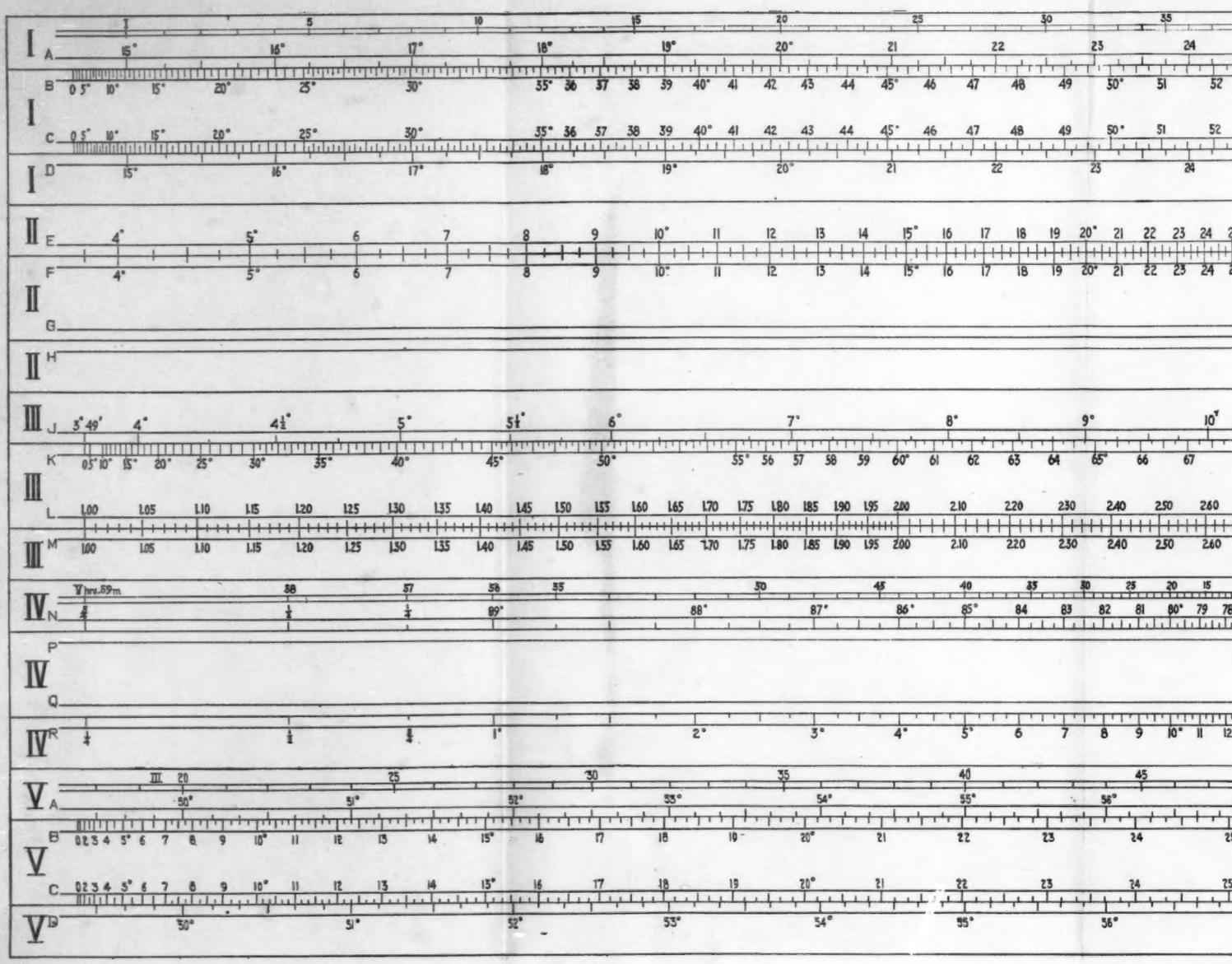
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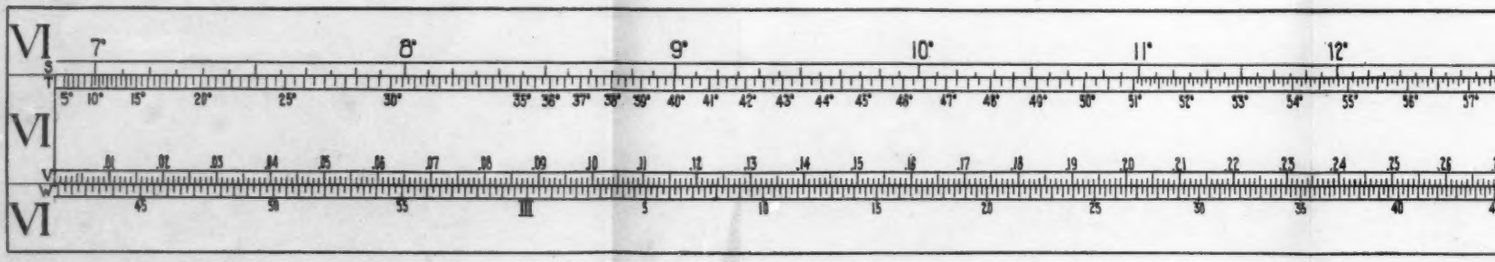
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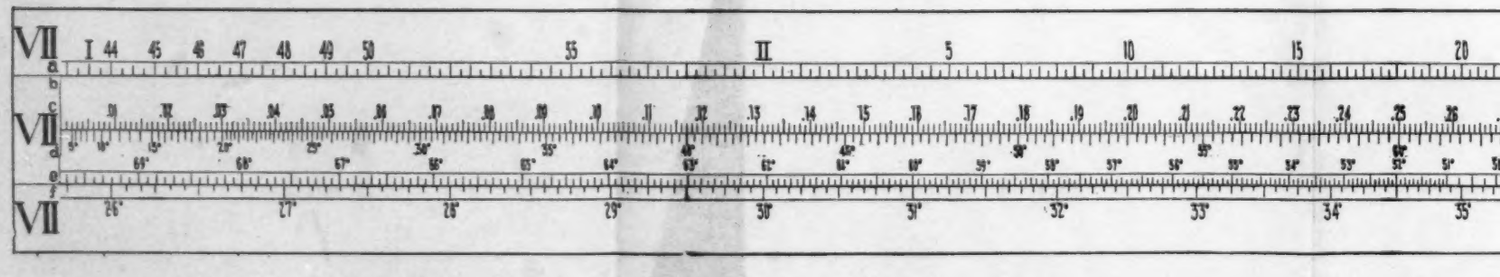
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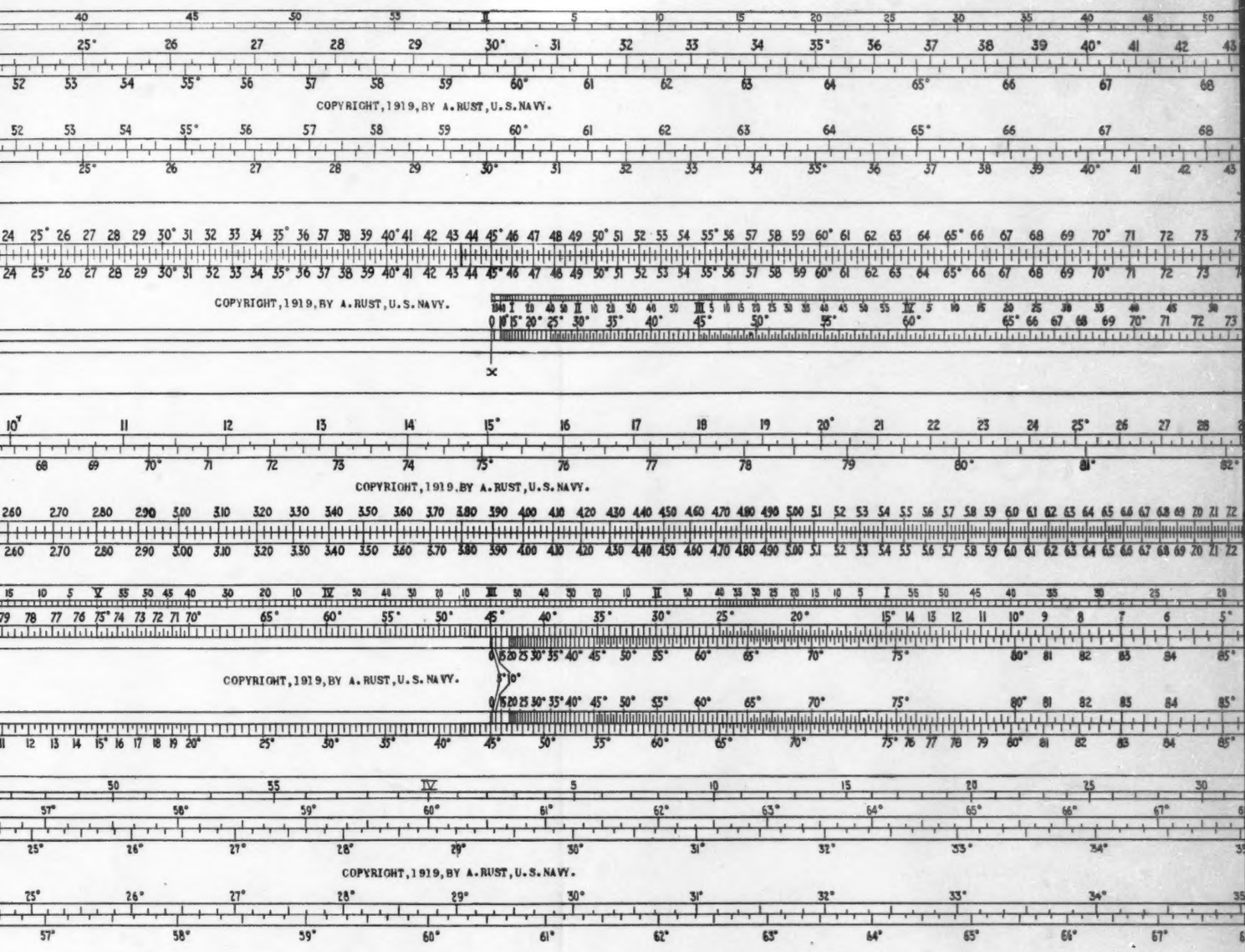
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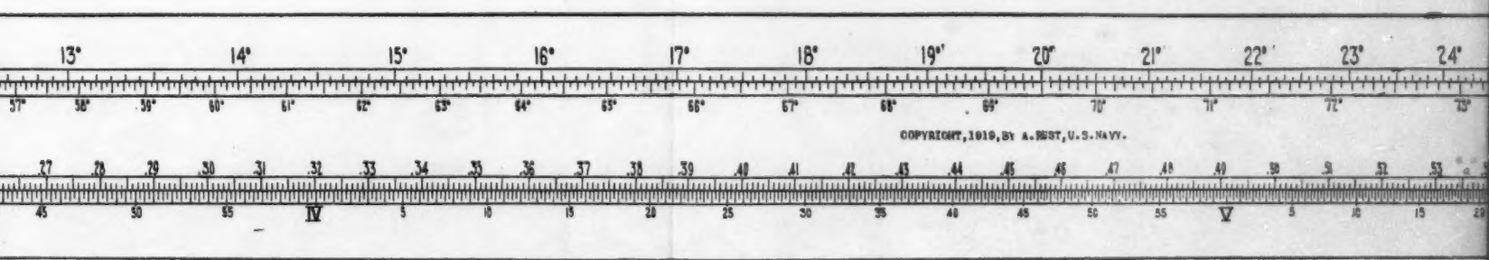
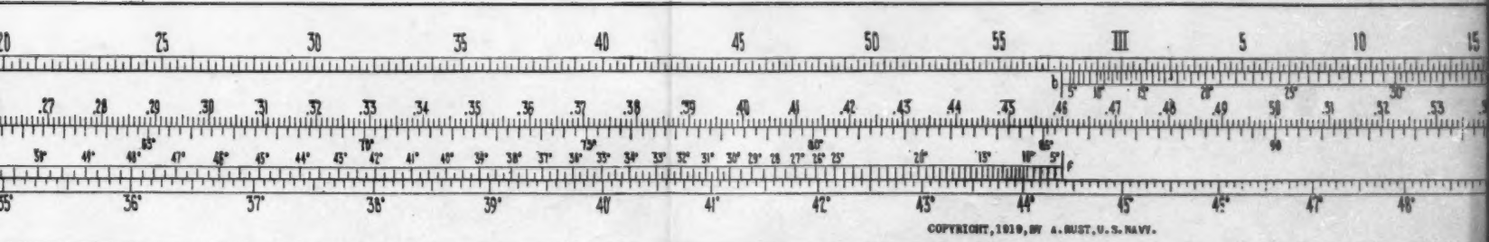
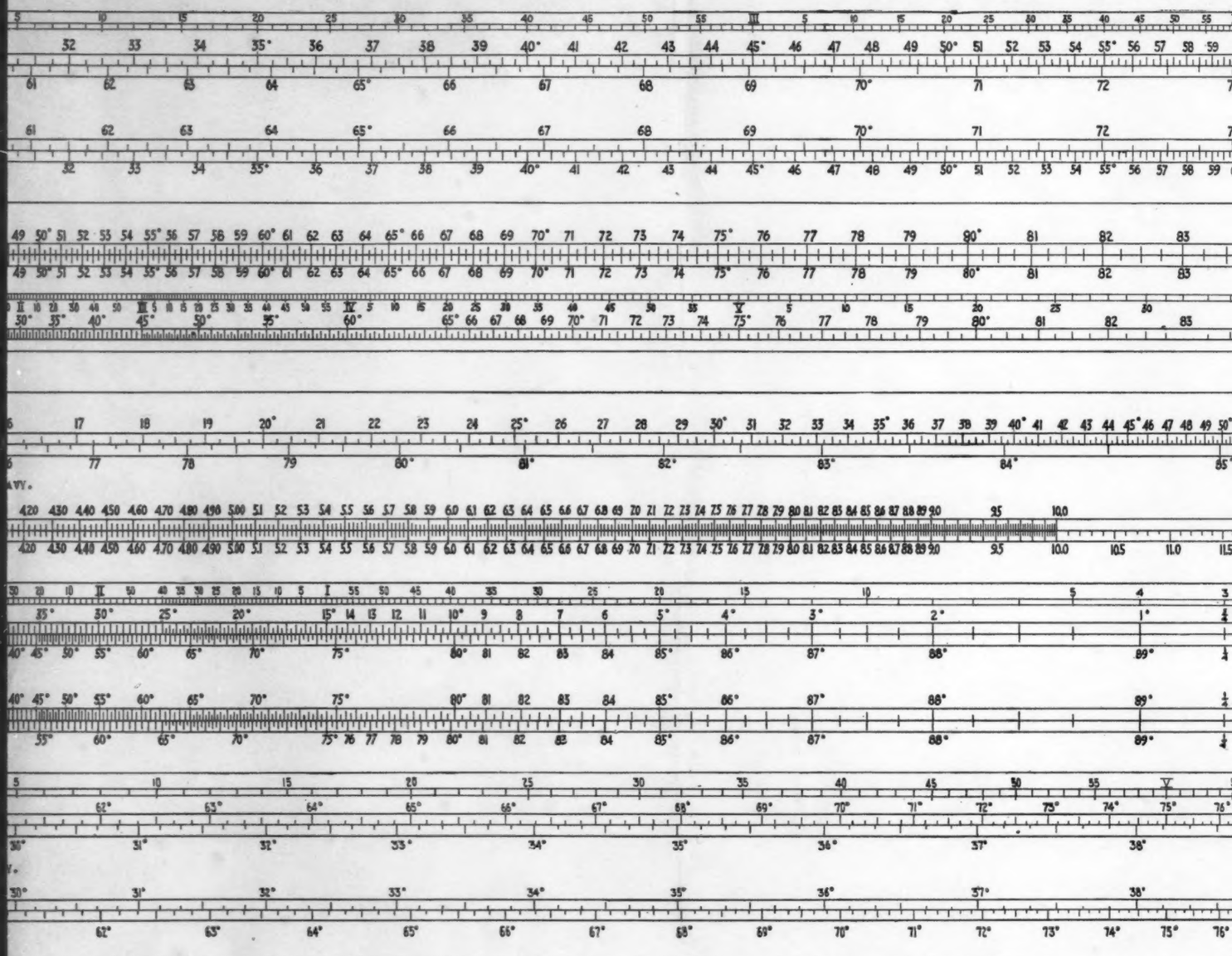
RUST'S SLIDE RULES FOR NAVIGATORS



RUST'S SLIDE RULE FOR TIME SIGHTS



RUST'S SLIDE RULE FOR THE MARCQ SAINT-HILAIRE METHOD



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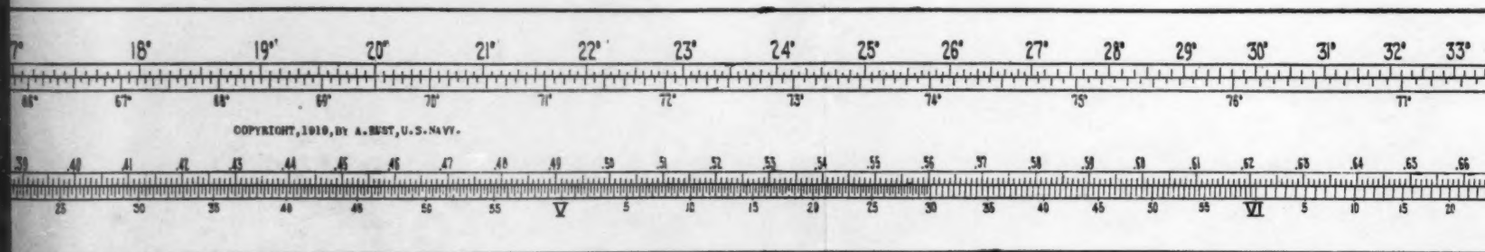

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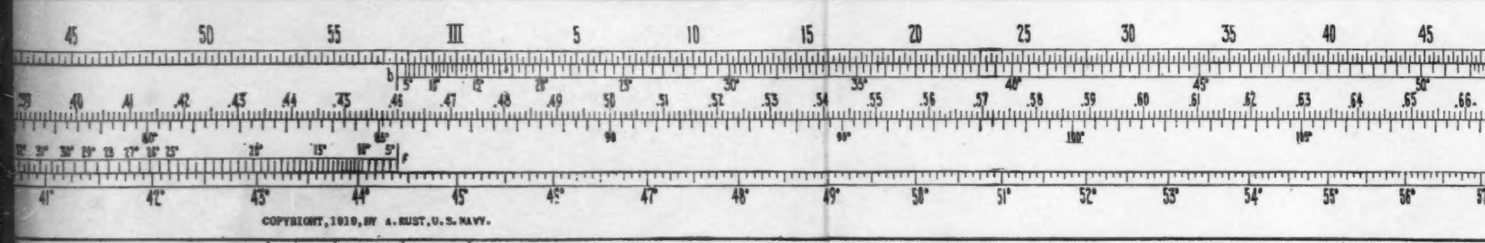
RUST'S SLIDE RULE FOR TIME SIGHTS



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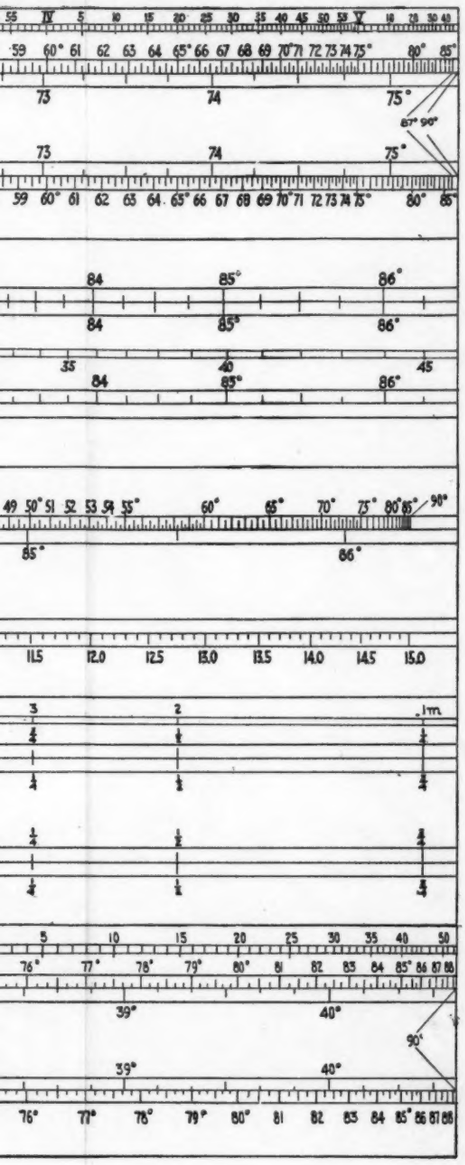
SLIDE RULE FOR THE MARCQ SAINT-HILAIRE METHOD



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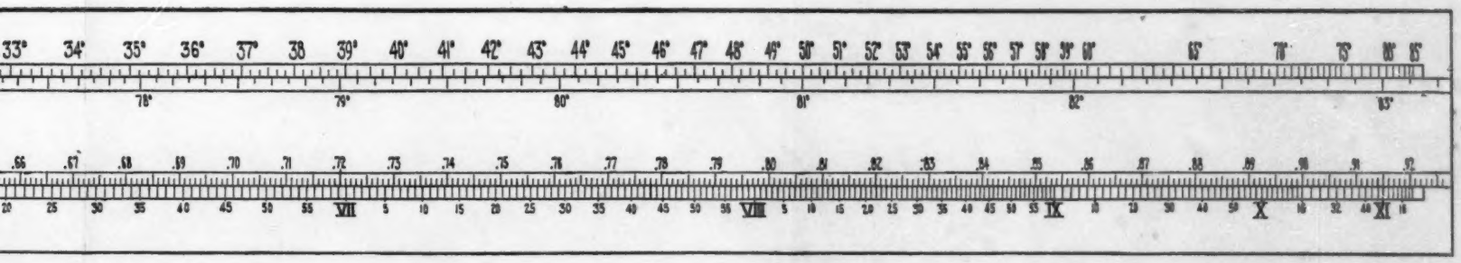

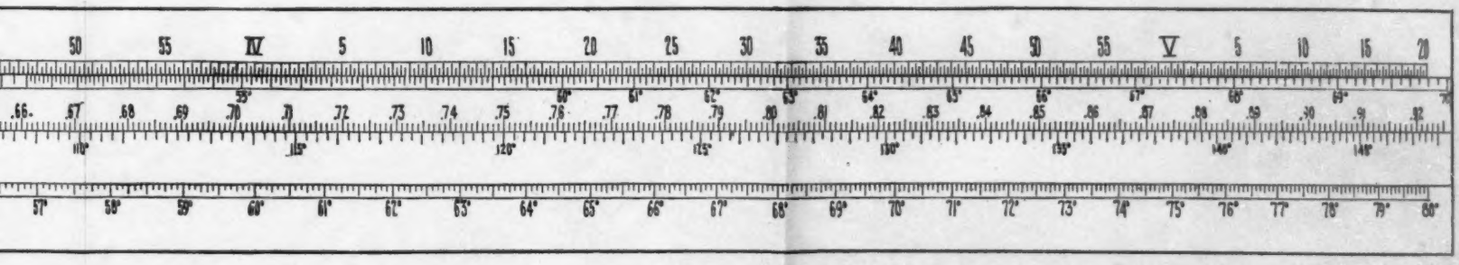

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

MORALE FOR OUR "NEW NAVY"

By ENSIGN (T) R. E. KRAUSE, U. S. Navy

There have been times in the history of our navy when, in order to meet an emergency, the interest and research of the naval personnel was directed into unusual channels. This was of course beneficial, but it was never quite clear when this deficiency had been met. Not that we had overdeveloped any particular phase but it was a case of having neglected something of vital importance. Shortly before the Spanish-American War we began to build our first modern battleships. Naturally enough, the interest of the officers turned to the planning and construction of these vessels, as well as to the guns with which to arm them. In short, we were providing the material. Later Admirals Mahan and Sims, in turn, pointed out to us that we had the weapons but were not proficient in their use. So to this day our officers have been striving to increase the skill of the naval personnel in the handling of the guns, torpedoes, engines, radio, etc., with what results we all know.

We are now due to pass to another period in which we shall have to devote increased attention to morale building. It is hoped that we are on a par with foreign countries as regards material and skill, so that we can let them rest for the moment and give our best to improving the spirit of the men. Morale is essential to a fighting force—for without it a fleet is beaten before the battle no matter how fine their ships and guns are. It resolves itself again into having our choice between a navy of "iron ships and wooden men" or one composed of "wooden ships and iron men." After mature reflection, no doubt most of us would prefer the latter. Fortunately morale, if not present, can be created. In our history the navy has never felt a similar need for creating a fighting spirit—it was always there. And, one might add, that

was about all we had at the beginning. Many was the time that the morale of our bluejackets won over the superior numbers and gun power of the British. We are prone to forget that the spirit which won victories for us in the days of the Revolution, the War of 1812, and the Civil War, has lost none of its power to win them for us in the future.

Some think that naval science has reached such a height that victory no longer is dependent on the morale of the personnel, but the two most recent great wars of the world strikingly refute this argument. In the Russo-Japanese War the outstanding element which won the battles for the Japanese was not a superiority of material or numbers but *morale,* in which the Russians were decidedly lacking. Lack of initiative was so general among the latter as to appear almost a national quality and similarly the lack of moral courage as shown by their leaders. At Tsushima while the Russians were deciding whether to fight or not the Japanese forces pounced on them—defeating them while they were still pondering. A more recent instance is the war with Germany. Naval experts invariably admit that Germany was second to none in excellence of material and skill in handling the same, while most assert that she was superior to all others. Yet there was no determined attempt made to break through or to decisively engage the British fleet. From the first it was the purpose of the Admiralty to avoid a serious contact. This tended to break down the morale of the officers and men until, toward the end of the war, they would not go out. For three years her battle fleet lay idle. Not only was this idleness decidedly injurious but the men must have felt that they were the under-dog, since their leaders refused to give battle to the British. Meanwhile the latter were active, cruising back and forth, and battling with the waves of the North Sea—all of which served to keep the sailors on their mettle. So we find that even though material and skill have been highly developed, morale is just as important as ever as a decisive factor in war.

For the sake of clearness we may define morale as being the mental state of the individual with regard to courage, confidence, zeal, and self-reliance. Courage is divided into two entirely separate, though often allied, classes: moral and physical. Moral courage will lead one to display a fearlessness of responsibility with its possible consequences. It will allow an officer to be governed by

attendant circumstances, regardless of regulations and precedent. In any case which calls for independent action he will be guided by the best interests of the service. It tends to develop initiative, which is so important in a service which tends to make machines of men. Every day of our lives we kill initiative when we "request instructions," "request assignment of berth," "follow senior officer's motions," and carry out the regular routine. This is no doubt necessary but we should recognize its consequences by putting a premium on initiative wherever possible. Moral courage must be re-enforced by initiative. When an officer is led by sudden circumstances to disregard instructions, regulations, and precedent, he must have the power of mind to devise suitable means or methods that are better than the customary ones for that particular purpose. If he cannot do that his moral courage will avail him naught. Moral courage is an indispensable quality for a military leader; therefore it should be valued highly wherever found. History is replete with examples of victories won by an officer's power to break away from existing regulations or customs, and as many failures by officers who feared the responsibility. It won the day for the British at the battle of Cape St. Vincent when Nelson ordered his ship to be wore in order to prevent a junction between the weather and the lee ships of the Spanish fleet. He did this in utter disregard of existing instructions and precedent, with full knowledge of what would happen to him if he failed. He had no authority of any kind but he had the quick perception to see the danger and the good judgment to know what to do.

Every man in the service should possess physical courage. If he does not have it when he enlists it should be developed in him. Fortunately this is possible and not very difficult. Every man is by nature afraid of the unknown or unusual, which can be overcome by association with these hazards. Gradually it will wear off, even though not entirely, but sufficiently so that the man will not show and be influenced by his fear. That is physical courage. It is said that Frederick the Great fled from his first battle but after his "baptism of fire" he never allowed fear to get the better of him. Physical courage, as well as morale in general, is largely influenced by physical fitness. Strength of body, agility in action, soundness of health, with the power of enduring fatigue and hardship, increase in large measure a man's

confidence in himself and his superiority over those who possess these qualities to a lesser degree. For this purpose athletics and all manly sports should be encouraged as never before. Systematic development of all parts of the body should be instituted and a course prescribed for each man, using for this purpose outdoor sports as far as possible. In this as well as along other lines of naval effort the officers should be the leaders by setting an example for the men. In addition to promoting courage, physical fitness is necessary to keep one mentally fit, so as to be at all times in readiness to assimilate education. The body supplies the energy that runs the brain and the latter will not function properly if one is run down physically.

Morale building is a difficult and intricate subject, especially so because the mind of the average American naval officer does not run in that direction. Hard and fast rules may be set for the upkeep of material but not so for the personnel.

No argument is as powerful as a good example, which must be set by the officers. Men are easy to handle and respond readily if the officer knows how. A would-be leader of men must himself understand discipline—ready to obey his superior officer as willingly as he would have his men obey him. He must be a man of character and intellect, able to command respect. He must show initiative as well as determination in the performance of his duty with a spirit of cheerfulness and consideration. He never asks a man to do anything he would not do himself. In short he must be an example in the way of his professional efficiency, morale, discipline, clean-living, and temperance; then, and then only, will he be able to get the best out of his men.

Discipline goes hand in hand with morale. Times have changed and the type of men we are receiving into the naval service have changed as well. The methods of maintaining discipline, formerly employed, do not meet present day requirements. Punishment as a deterrent force and as an example is still frequently practised, but if the officer or man is to be retained in the service no degrading punishment should be visited upon him, such as would tend to destroy his self-respect or the estimation of him in the eyes of his shipmates. The brig should be the last resort for a man who is in any way disposed to brace himself and has a feeling of pride in himself or the naval service that can be appealed to.

Justice should be meted out in any case, be it officer or enlisted man committing the offense. The double standard of conduct for officers and enlisted men is far too much in evidence. Why an officer should not be called to account for committing certain offenses for which an enlisted man would get a summary court-martial in every case is inconceivable to all enlisted men, as the writer knows by personal observation. Nor can the writer even now, after eighteen months service as an officer, understand why this state of affairs should exist. If anything, an officer should be made to come up to a higher standard because he should know better. Pride in the service is little promoted as long as such conditions are tolerated. No gulf should exist between officers and enlisted men, but rather it should be a gradual progression upwards as a man qualifies for a higher grade by reason of his increased professional efficiency. It is well for us to remember that we are all men whatever our rank or rating. Treat your men as you would be treated were you in their position. Sometimes we become skeptical as to whether we are dealing with men or some other species of lower mentality. Every officer has come in contact with men whose brain mechanism he could not fathom. Sometimes it appears as if enlisted men don't use their brains and some officers take it that they don't think. That is far from the truth, as those of us who have bunked and messed with them know. Such officers who hold this erroneous opinion will never be successful as morale builders—as leaders of men. In cases like the above mentioned it just shows that the officers concerned have not made a study of men.

Mast, as it was formerly held, should be a custom of the past. It has been, and is yet to some extent, the practise to intimidate the men or to abridge their right to speak.

The captain of a certain vessel was holding mast and as usual had a line of more or less repentant sinners in front of him. A young seaman, in turn, stepped up, saluted, and jerked off his hat.

"You are charged with being absent over leave. What have you to say for yourself?" snarled the captain.

"Why, sir, I-a-."

"Shut up! Shut up! I'll get you for lying," bellowed the captain. "Five days solitary confinement. Next!"

Can you expect this seaman to be thrilled with pride in the service which tolerates such injustice? Do you think such a sys-

tem tends to promote the efficiency of our man-of-war's man and the naval service? Of course such methods will rarely be found employed at the present time but less flagrant ones are still in general use.

We now have on our hands the task of reorganizing the navy. Now is the time to sow the seeds for developing morale in our "New Navy," such as crowned the efforts of the British fleet during the time of Nelson with success. Many of our old men have left the service and the majority of our personnel is young and inexperienced. This is the time to mold them as we want them into efficient man-of-war's men, who take a pride in and love the service. Let us face the fact squarely that the responsibility will be ours if we fail. Let us all face the task like men—not by drinking toasts to the old navy that has gone by but by showing an increased zeal and devotion for our "New Navy," that will be better than the old.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

THE PRACTICAL NAVAL OFFICER[1]

By Rear Admiral Wm. S. Sims, U. S. Navy,
President, Naval War College

At the reopening of the college after the end of the war, I delivered a short address to the class of June, 1919. If there was anything in that address that proved of benefit to that class, it should be equally useful to this class of December, 1919, which it is now my duty and pleasure to welcome. The logical course would therefore be for me to repeat the address for the benefit of the new class. But as that would be rather hard on the old class, which, being of six months standing, is probably somewhat restive under advice, I will spare them that affliction—but only upon the understanding that the new class will read the address in question, because I have therein invited attention to the specific mission of this college and to the means which I believe to be essential to the realization of that mission.

Seven years ago last month I delivered to the officers of the Naval Academy a lecture on the "Practical Character of the Naval War College." Those whom I consulted at the time advised me that the paper was a bit too elementary. Though somewhat inclined to the same opinion, I gave the lecture as it was written. Since that time I have had occasion to observe the service mind on this subject, both in peace and in war, and in consequence realize even more fully now than then the importance of doing everything possible to convince our officers of the absolute necessity not only of training in the art of war, but of training in systematic and logical thinking.

This necessity was brought home to me with tremendous force on more than one occasion during the war by certain failures of

[1] Address delivered before the opening course for class of December, 1919, at the Naval War College, Newport, R. I., December 2, 1919.

officers to reach logical conclusions which imperilled the lives and property they were responsible for guarding. I will cite a typical example:

A valuable convoy was approaching a certain submarine zone. The problem was to protect it against the attack of enemy submarines. A certain inadequate number of destroyers was available for this purpose. On the way out to meet the convoy they were ordered to make a sweep of a very wide area across the zone—a distance of about 200 miles. Upon meeting the convoy, half the destroyers were to form its escort and the others were to continue the wide sweep at a considerable distance from the convoy.

In view of the fact that a destroyer is visible from a submarine many times as far away as the submarine is visible from the destroyer, and also that the U-boat can submerge at will in 30 seconds, it is apparent that the sweeping operations were not only a useless waste of fuel and energy, but that the convoy was needlessly imperilled by detaching half of its already insufficient escort.

We may be sure that any officer who had had adequate training in the systematic reasoning necessary to make correct estimates of simple situations could not possibly have been guilty of such a dangerous blunder.

There were not a few such blunders in the early part of the war, and in all cases that came to my notice they were made by so-called practical officers—that is, by officers who honestly and tenaciously held the extremely dangerous opinion that if they efficiently performed all their duties at sea throughout the various grades, they would thereby render themselves competent to perform the independent and responsible duties of the higher grades.

My principal object upon this occasion is to show the fallacy of that opinion, and to this end I will repeat the essential parts of the lecture above mentioned.

It contains some illustrations that would not be necessary in addressing experienced officers who have shown their appreciation of the college by their applications to take the course; but some of these illustrations have been retained because of the possible influence they may have upon our younger officers, and also upon those hard-headed men who do not yet understand that this institution is of practical value to the service. The lecture follows:

THE PRACTICAL CHARACTER OF THE NAVAL WAR COLLEGE

Twenty-seven years ago Admiral Mahan delivered an address, at the opening of the Naval War College in 1892, that bore the same title as this lecture. It was published in the Naval Institute in 1893. It is of course sound in every particular, and will repay a careful reading. It shows with entire conclusiveness that the study of the history of naval warfare is in no sense a theoretical proceeding, but essentially a practical one that is entirely indispensable as a preparation for actual conflict; but, as the war games and the applicatory system of training had not been introduced at that time, the address does not indicate the additional necessity for constant mental practice in the application of this knowledge of war by means of these games.

It will be one of the principal objects of this lecture to supply this omission, and to explain as clearly as possible not only the practical character of such studies but the imperative necessity of these mental training exercises.

One of the first things a student learns at the Naval War College is to appreciate the value of a systematic and logical method of arriving at a decision. Whenever we are given a task to perform, the college teaches us first to state our mission, then to make an estimate of the situation, and finally to form our decision or conclusion. I will try to adhere to this principle.

My present mission is to show that a knowledge of the art of war, and training in the application of this knowledge, are vitally necessary to success in naval warfare; and I hope to be able to indicate clearly how this knowledge and training may best be acquired by our officers.

The primary object of the Naval War College is to study the principles of warfare, as enunciated by the great masters of the art, to develop the practical application of these principles to war on the sea under modern conditions, and then to train our minds to a high degree of precision and rapidity of decision in the correct application of these principles.

In order to form a correct conclusion as to what should be done, it will be necessary to make a candid examination of where the service stands in reference to the important feature of preparation for war; that is, we must make an estimate of our present situation in this respect.

Such an estimate should show, as clearly as possible, the elements of preparation that are essential to success, wherein and to what degree we have failed to realize them, and what direction reform should take.

We all recognize the necessity of building a navy the individual units of which are as numerous, as well constructed, as fast, as well manned, as well trained, as well equipped, and as well supplied as the navies of our possible enemies; but perhaps we do not all quite fully realize that such a navy cannot reasonably be expected to succeed in war unless the man who directs the whole and the men who direct the various elements—the squadrons, divisions, flotillas, and individual ships—not only know the principles of the art of war, but have their minds trained in the application of these principles to such a degree that they will all be actuated by a common doctrine of war, which doctrine will enable them to coordinate their several actions in furthering the general plans of the commander-in-chief.

I say that the necessity for mental training is not yet fully realized by the service. Of course, all officers understand in a general way that we must know how to handle a great fleet if we expect to succeed in strategy and tactics; but I am sure that I am not wrong in stating that too many officers tacitly assume that this knowledge will come to them as a result of a faithful discharge of their duties as they advance in years and grade towards positions of command and responsibility.

So far is this from the truth that no apology seems necessary for any length of illustration that may be required to show its fallacy, and its extreme danger.

I am going to attempt to explain this by using as an illustration the method of training employed in a game with which you are all very familiar, namely, football. This game does not cover a sufficiently extensive field to serve as a complete illustration of the strategical and tactical difficulties involved in handling a great fleet; but it will, I believe, serve well enough to make clear the distinction between the two essential elements of success; that is, first, the strength, equipment and training of the individual units and, second, the training of the guiding and coordinating minds.

Let us, therefore, examine the principles and methods of training which have enabled us to attain such a high degree of excel-

lence in playing this strenuous game. If you want to teach your team to play successful football, you set it to work actually playing many games against other strong teams. The players themselves develop by experience new plays and devise methods of counteracting the plays of the opposing team. This they do under the guidance of coaches, who are men who have made a special study of the subject, who are experts in the art of football war.

In playing these games against other college teams, your men are getting ready for a football war that will be declared against West Point in November. These practice games are similar in all essential elements to the "war game" you will play against your friendly rivals of the other branch of our military service.

Your method of training is, therefore, perfect in all respects, simply because you can repeatedly make exactly the same kind of "war" in your practice games that you will make in the great game at the end of the season.

If we could use our great fleet as frequently in actual battle with other fleets, our preparation for a naval war would thus be rendered equally thorough; but of course this could not be done without the loss of many ships and many men. We must, therefore, seek some other method of instructing and training our officers in the art of war.

In order to illustrate the nature of the methods that we are forced to use in training our officers to handle a fleet in war, let us suppose that our football games were as deadly as naval battles. Suppose that a game with West Point, or with any of the other colleges, always resulted in the death of at least five or six players of each side. If that were true, it is evident that you would have to give up your practice games with other colleges and devise some other method of training for the great game with West Point.

Assuming that the public interests required the West Point game to be played, what would you do about it? Manifestly you would get up a kind of practice game that was as nearly like the real thing as you could make it without the risk of actually killing anybody.

In playing such practice games with eleven men on a side, you would be using your brains to get up new plays and your bodies to carry them out, as far as you could do without causing any deaths. In every such game you would be training your minds

in anticipating the probable strategy of the enemy and in making rapid decisions to resist his attacks as soon as they developed.

Our method of training officers to handle a great naval force with the highest possible efficiency in battle is necessarily very similar to that which would be required for training a team to play football if the latter game were as deadly as a naval action. The captain of such a team corresponds to the commander-in-chief, and the players correspond to the individual ships and their commanders.

The football player consists of a body of flesh and a brain. The fleet unit consists of a body of steel, and a brain—the captain. Both are essential to success.

The real business of the navy is preparation for war. All of its training must have that end in view. If war should unfortunately be forced upon us, it must find the fleet prepared in every particular. Such preparation comprises many different elements. We build our ships as strong, as swift and of as great gun power as possible, and we train their crews to the maximum practicable degree of efficiency.

We train ourselves to maneuver the ships accurately and to shoot the guns with the greatest possible precision. Similarly the men of the football team are trained until each is as capable as we can make him.

Now, suppose we assume a group of perfectly efficient battleships and a squad of big, strong, athletic midshipmen, and see what we should have to do to obtain an efficient fleet and an efficient football team. Let us take 22 ships and 22 midshipmen and assume that both ships and middies have been trained individually, but that they have never practiced maneuvering together, or playing any game together. Divide the midshipmen into two teams of eleven each, and what success would they have in playing a game of football? Needless to say, there would be no team work, no combination plays, and in place of intelligent direction of the whole there would be collisions and general confusion. They could probably be outmaneuvered and beaten by a good high school team.

If ships that have never been trained together as a fleet were to fight a battle, they would have a similar experience; neither the men nor the ships can do much

1. Until they have mastered the theory and all the practical fine points of the game.

2. Until they have practiced working together until they can act as a single body—as a real team—in applying all these fine points.

But there is still another element of success, the most important of all, and that is the man whose brain directs the whole action. The football team must have an efficient captain and the fleet must have an efficient commander-in-chief. These are the men who train their respective teams to act as a single body. They must not only have complete knowledge of the strategy and tactics of the game, but they must train their individual units to understand and apply them. They must develop new plays and devise the signals that indicate them; and they must have rapidity of decision, inflexible determination of character and plenty of nerve to carry out their plans of operation.

All of these really military qualities are wholly essential to success. For example, a man may, in the solitude of his study acquire at least a complete mastery of the theory and principles of football, or of the strategical and tactical principles governing naval warfare. This is knowledge, but indispensable as it undoubtedly is as a guide, and valuable as it may be in preparing the mind leisurely to reach a correct understanding of the significance of any situation that may arise, it is not an adequate training in the personal qualities that make for success in battle. These qualities are moral and mental ones. They comprise the ability to recognize, not leisurely, but promptly, the military significance of each strategical and tactical situation; ability to withstand surprise without impairment or suspension of judgment; rapidity of decision and promptness of action; and inflexible determination in carrying out the plan of operations.

These indispensable qualities of mind and military character can be acquired in no other way than by constant and intense competitive practice—constant and intense training of the mind and the will through handling the various types of situations in competition with alert minds that are handling the forces on the other side. We all recognize the importance of complete theoretical knowledge of the principles of any subject, and the importance of a complete mastery of all the practical details involved; but it may be doubted whether we all fully realize the no less imperative necessity of actually training our minds to apply the principles of naval warfare with that confidence, rapidity, and

determination without which success is not possible in conflict with a well-trained enemy.

This subject of mental training through constant mental practice is of such importance that, even at the risk of tediousness, I will attempt still another illustration, also based upon the game of football.

Suppose a thoughtful and studious midshipman should come forward with a team of eleven men and base a claim to the honor of defending the academy against West Point upon the following grounds:

> My team is composed of the eleven best athletes in the academy. I have trained them physically until they are each of them stronger and faster and have more endurance than any other men on any other team in the country. They can kick a ball straighter and farther than any others, and they can tackle harder. We have not paid any attention to any of the books or articles written by the masters of the game, nor have we received any instructions from these experts. We have practiced a bit with the ball on the field, but we have never played a real or a make-believe game against another team; but as we are individually stronger men, swifter men, longer kickers and harder tacklers than any others in the country, we believe we can win.

It needs no argument to show that such a team could not win if pitted against another team all of whose members had been thoroughly drilled in team work under competent coaches, and thoroughly trained in many actual games against other strong teams. The eleven individually trained men could not win because a well-trained team, even though composed of weaker men, would have the enormous advantage of the ability to act as a whole, without confusion and with confidence and precision, under the leadership of a captain whose mind has been trained, in actual conflict with other minds, to accuracy of judgment, readiness of resource, and promptness in action.

Applying the above illustration to our naval service will, I believe, show not only a marked resemblance in conditions between the navy and the untrained team of eleven strong men, but will indicate very clearly the nature of the means necessary to render the navy efficient.

Analyzing the principal elements of success in football and in naval warfare, we find the following striking similarity.

There are three primary elements that are essential to success in football, namely: Efficient material, adequate knowledge of

the game, and adequate mental training in applying this knowledge.

1. Efficient material requires individual team members who are physically well developed and well trained, strong, swift, hardy men who can buck the line hard, kick hard, and take punishment.

2. Adequate knowledge of football—a mastery of the theory of the strategy, tactics and practical details of the game.

3. Adequate mental training—a leader and men whose minds have been trained by constant team practice to apply their knowledge and strength with the utmost rapidity and mutual confidence, and to take instant advantage of any situation that arises.

There are also three primary elements that are essential to the success in war of a nation's fleet, namely, the same elements—efficient material, adequate knowledge, and adequate mental training:

1. Efficient material requires fleet units individually well trained, ably commanded, powerful, swift, and able to give and take hard knocks.

2. Adequate knowledge—leaders and commanders who have a thorough knowledge of the art of war.

3. Adequate mental training—a leader and commanders whose minds have been trained by constant team practice to apply their knowledge with the utmost rapidity and mutual confidence, and to take instant advantage of any situation that arises.

As previously explained, you can and do develop to the highest degree all the three elements of success in football by your present methods of training. You have the husky men, you know the game, and you can develop your ability to play the game by practicing it as much as you wish under exactly the same conditions as those that will pertain in your final games.

Contrasting these facilities for developing football with our facilities for developing naval efficiency, we find the following unfavorable comparison. We have the ships, strong and well trained individually. But very few of our officers have received any instruction in the art of war, and an insignificant minority has received adequate instruction. Very few officers have received any competitive training in applying the principles of naval warfare, and almost none have received adequate training.

Our navy, therefore, corresponds at present very nearly to the eleven candidates for football honors who are strong, who are

swift, who can kick, but who have not studied the strategy and tactics of the game, and who have never played it, or even seen it played.

The question is, what are we going to do about it? We are rapidly perfecting our material. We are now building ships that we believe are at least equal in power to any afloat. Our discipline and ship training are good, and we feel sure that we are second to none in hits per gun per minute at the longest practicable ranges; but we, the officers of the service, know little about war, and we are not training our minds to use efficiently even the little we do know.

Manifestly, our requirements are to educate our officers in the art of naval fighting, and to train their minds to apply their knowledge with maximum of efficiency.

How are we going to do it? Obviously, we cannot acquire the necessary knowledge and training by actually fighting our fleet against another. We cannot acquire much of it by service in the fleet. We must perfect an organization that will provide our officers with the necessary education in war, and devise games that will train their minds in applying this knowledge.

For more than 25 years we have had, in the Naval War College, the necessary facilities for providing this knowledge and training; but, unfortunately, the importance of its function has been so little understood that the plant has been throughout many years practically idle, through lack of the raw material—student officers. Admiral Luce, aided from time to time by a few other farseeing officers, after years of agitation, succeeded in having the college established, but upon several occasions they were forced to exert their maximum influence to prevent its abolition. At times it was doubtful whether they could retain even the building. Sometimes there were two members on the staff, sometimes half a dozen. Short summer conferences were held which served, as Admiral Luce states, to acquaint officers with the terminology of the art of war and show them how much they had to learn; but not until 1911, when the long course was created, and the essential applicatory system of training thoroughly established, under the presidency of Captain William L. Rodgers, were any regular students sent to the college. It was the only institution of learning in the world that had a building and a faculty, but no students.

Of course there was a reason for the Department's action. The various secretaries have usually acted in such matters upon the advice of naval officers—advice which was, of course, based upon honest convictions. It is important, therefore, to examine the nature of these convictions for there can be no doubt that they still exist, though doubtless in less degree.

This state of affairs is the result of the too prevalent opinion in the service that the college necessarily devotes its attention to "High-Brow Theoretical" studies, and that these are of little more than academic interest or importance in comparison with practical experience and the sea habit. Stated in its usual form, this singular conviction is that "theoretical" knowledge does not help you much in acquiring proficiency in practical work; that the best possible preparation for the duties of any grade is practical proficiency in the grade immediately below it; and the conclusion of the so-called "practical man" is that War College work, as he understands it, is mainly in the line of what might be called "naval culture"; that while it may be interesting to the man who has a taste for that sort of thing, and a ready pen to expose his theoretical reflections, it cannot be of much use to the real salty naval officer.

Well, if I cannot succeed in dispelling this illusion, I shall have wasted my time and yours. Let us, therefore, examine the conviction of the "practical man" and see if we cannot discover the basis of his point of view. I know what his point of view is, for I have heard it explained by many officers who honestly believed they were becoming qualified for higher command; but I have also in many cases seen it gradually abandoned by officers as soon as they became acquainted at the college with the very *raison d'être* of that institution.

The "practical man's" conclusion is correct up to a certain point. It is true that the efficient performance of duty in each of the grades below command rank is an excellent preparation for the duties of the next higher grade; and it is equally true that the War College will not supply him with much information that will be useful to him in performing these duties; but where the "practical man" goes astray is in his almost inevitable assumption that this applies equally to all grades.

The reason that the assumption in question is usually applied to all grades, including the higher ones, is doubtless because it

is true as regards the great majority of the grades—that is, the junior grades. The peace duties of junior officers—gun-division officers, navigators, first lieutenants, engineer officers, gunnery officers, and executives are most excellent training for the principal duties they will have to perform in time of war.

But, and this is the gist of the whole matter, the assumption is true only to a very limited extent as regards officers who exercise command of ships, divisions, squadrons, fleets, or any other separate detachments.

It is distinctly untrue that the duties that these higher officers perform in time of peace are anything like an adequate training for the duties they will have to perform in time of war.

Moreover it should be especially noted that it is, and always will be, physically impossible to obtain such training by service in the fleet, no matter how extended it may be. This impracticability is due to the simple fact that it is not possible actually to use great fleets to play a sufficient number of war games to provide its officers with adequate mental training in strategy and tactics.

Let me state a concrete case. Assume that we have, mobilized at Hampton Roads, a fleet consisting of:

35 battleships	100 colliers
10 armored cruisers	4 advanced base ships
30 scouting vessels	6 troop ships
12 gunboats	30 torpedo boats
50 destroyers	40 submarines
20 auxiliaries	
	337 vessels

A European nation has declared war for the purpose of acquiring a naval base in the Caribbean, and has just despatched an even more powerful fleet.

How, in the exercise of command in time of peace, could the commander-in-chief and his subordinate admirals and detachment commanders have acquired the knowledge of war and the mental training necessary to enable them to draw up and carry out efficient strategical plans of operation, to organize the force in the manner that would most efficiently meet the requirements of the situation, and to handle it with success in actual battle?

The process required to accomplish this is chiefly a mental one. Previous experience in ordinary fleet service will be of little use. A knowledge of the principles of warfare derived from a study

of the great masters will be indispensable; but this knowledge can be successfully applied only by minds that have been trained by much practice in the solution of just such problems, and in the formulation of orders that will insure the commander's intentions being carried out in complete coordination with his plans.

Manifestly, the fleet cannot be used as a means of acquiring this essential mental training except to a very limited extent in the practice of minor problems; but even such practice will not supply the knowledge of the principles that are to be derived only from the history of warfare; and without adequate acquaintance with these principles even the most extensive practice of minor problems cannot do much more than train the mind in the application of such knowledge as is already possessed.

Again, we may ask, what are we going to do about it? We would go down under a storm or ridicule if we attempted to beat West Point with eleven superb athletes who did not understand, and who never had practiced, the game.

What sort of a storm do you think it would produce if we should attempt to hold the Caribbean or defend the Panama Canal with a fleet of superb dreadnoughts commanded by men who did not understand the game and who had never seen it played, even in miniature? The result would doubtless be a disaster, so complete that the country would not recover its prestige in fifty years, though it might rebuild its fleet.

I do not wish to be understood as implying that all our officers are ignorant of the art of war and untrained in the application of its principles; but it must be perfectly apparent to any one acquainted with the facts that, barring a wholly insignificant proportion, the commissioned personnel of the navy is not now being systematically and adequately educated for the performance of its higher duties in time of war.

It is evident that this essential education must be provided for. There remains only the question as to the most efficient method; and since it is materially impossible to carry out with the mobilized fleet exercises that are sufficiently extensive and sufficiently numerous to provide the necessary training, it is equally evident that we must devise some form of game which will require, in order to win, the same knowledge of the art of war, and the same exercise of the mind in applying this knowledge, as would be required in actual war.

It must be a game that can be played hundreds of times, or often enough to enable the student to correct at least all fundamental mistakes—which is a requirement that is essential to any adequate mental training.

A commander-in-chief and his subordinate commanders who have been trained in such a manner will be prepared to meet the probable strategy of the enemy. The training itself will have developed a doctrine of war so fixed as regards its fundamental rules and principles that when an order is given it will be understood and obeyed in the light of this common doctrine.

I know from experience that the omnipresent "practical man" often regards such games as too theoretical to be of benefit to him. Let us, therefore, examine the point in sufficient detail to make clear the practical nature of the war training in question.

The college war games—the tactical games and maneuvers—bear the same relation to efficiency in handling a fleet as dotter and subcaliber practice bear to efficiency in handling a ship's battery, or as practice on the field bears to efficiency in handling a football team.

A man practices with the dotter until his mind and muscles are so trained that continuous aim becomes nearly a subconscious process.

Men practice on the football field until their minds are trained instantly to meet and act upon any situation that may be presented. Their method of training is perfect.

Similarly, officers practice the war games until their minds are so trained that decisions flow naturally and almost automatically from the war doctrine developed by the training itself.

We use the dotter because we cannot fire the guns often enough to get the necessary amount of training; and, similarly, we use the war games because we cannot use the fleet often enough to get the necessary amount of training.

You have all seen how the dotter practice develops ignorant and untrained men into expert gun-crews.

You have all seen how the subcaliber practice develops the efficiency of the fire-control party and of the battery as a whole.

You fully realize, I am sure, that these practices, though theoretical in a sense, are in the highest degree practical training. You have doubtless noticed that in all cases the training is a process of making mistakes and correcting them.

You have all seen the husky untrained midshipmen successfully trained by practice until they become alert, quick minded and expert football players. You fully realize that without such mental practice, such a process of making and correcting mistakes, success would be impossible.

Similarly, if you should attend the Naval War College, you would see exactly the same kind of a process being applied to officers. You would see young officers of excellent attainment, as regards all the duties of their grade, commence to play the games in the same mistaken and blundering manner, and, by the process of correcting their mistakes, become relatively expert, attain confidence in the application of their knowledge, ability to give and understand military orders, and promptly to act upon them in coordination with the commander-in-chief. Confidentially, I may say that some of the older officers who attend the college have exactly the same experience.

I think you will recognize, therefore, that these so-called theoretical war games are no less practical as a training of officers in handling a fleet than are the dotter and subcaliber practices in training men and officers in handling a ship's battery.

We may, in fact, regard these games as, in reality, nothing more nor less than dotter and subcaliber appliances that have been devised for training officers in the application of the art of war. In each case we use an inexpensive miniature appliance that supplies the same kind of mental training as the real thing; and we do this simply because we cannot use the real thing for this purpose.

As a matter of fact, the college war games possess the greater practical value, because they serve to develop new applications of the principles of warfare as applied to modern naval conditions. From lectures that will be delivered upon these subjects you will doubtless learn that certain new features of tactics were not derived from individual inspiration or reasoning, but are the direct result of the conflict of many minds striving in tactical games to outmaneuver each other. They will also explain how the tactical game demonstrates the necessity for new or modified types of vessels, or new or modified uses for those already built.

These games are played under rules that are as nearly like actual conditions at sea as our present experience will permit us to formulate. The practicability of rules and certain maneuvers are tested in the fleet and modified accordingly.

Let me here invite your attention to another significant fact concerning these war games, and that is that an admiral who handles a great fleet in war will be obliged to do so in very much the same manner as that in which a paper fleet is handled in the games, and this for the simple reason that it is not physically possible to handle it in any other way.

In the comparison made between an untrained football team and an untrained fleet, I have, for simplicity, purposely assumed a fleet of eleven vessels. This is hardly more than a squadron, to be handled, like a football team, under the immediate eye of its commander. But the man who directs extensive naval operations has a much more complicated task to perform. He may have under his command no less than 140 fighting ships of various classes, not including torpedo boats and submarines and auxiliaries.

As such a fleet, even in massed formation, would cover an area of over 100 square miles, and probably 1000 before the action was over, it is evident that but a small part could be within view from any one position; and that therefore the commander-in-chief would have to be guided by a study of the positions of the various subdivisions as plotted on a chart—which would be exactly the same process that he would employ in war games, with respect to detachments that were beyond the range of vision, or so far away that their maneuvers could be determined only by instrumental measurements. The same process would of course be required in controlling the strategical maneuvers that preceded the tactical engagement.

Thus it will be seen that, in order to play these war games with success, the leaders require the same kind of knowledge and the same kind of mental training as they would require to conduct successful naval operations. They are, therefore, not only highly valuable training, but training of the most practical possible kind.

I hope I have made it clear that these war games are not only eminently practical as a means of acquiring essential mental training, but also that this training cannot be acquired in any other manner whatever; that the really practical men are those who study war and train their minds to conduct it with success; that an officer's whole career should be a preparation for the duties that may devolve upon him in a time of great national danger.

My contention is that we should devote at least as much thought and energy to preparing ourselves to win battles on the sea as we do to preparing our football teams to win games on the gridiron.

And now a word as to the duty of individual officers in this respect.

It need hardly be more than stated that any system of naval organization is fundamentally defective which does not provide for the systematic and adequate education and training of its officers in the art and practice of war; but in the absence, or inadequate operation, of such an organization, much can be accomplished by the individual, and much more by cooperative work, where practicable.

It seems evident that any man who once grasps the real significance of his position as a naval officer; who once realizes that he has signed a contract to do his utmost in defense of the country in time of danger, will begin to prepare himself for the duties that will devolve upon him. And, when he once realizes that he cannot efficiently perform these duties unless he understands war, he will doubtless employ some of his leisure time acquiring that knowledge. If he can do nothing else, he will have accomplished much. His mind will at least be stored with the knowledge that will make it ready to be trained in its correct application.

But if, in addition, he can, in association with those with whom he is serving, get some of the war training herein described; if he can manage to play a few war games, even in a modified form, he will have accomplished a great deal in the way of preparing himself—his mind—for war.

Moreover, he will find that these studies and exercises have given him a new point of view as regards the naval profession. When he once clearly sees that his real mission is to do his part at all times in preparing the navy for war, and in helping others to do the same, we may be sure that even his most irksome routine duties will take on a new significance and be lightened accordingly.

I need hardly say, that, in my opinion, all officers should be given the opportunity, either at the War College, or in War College Extensions, to study the art and practice of war.

In describing the attitude of the "practical man" it is not meant to imply that neither the fleet nor the service in general takes any interest in the work and aims of the college, for such is not the case.

Some subdivisions of the fleet are now doing a certain amount of work in the way of solving strategical and tactical problems similar to those used at the college, and in studying the art of war. In addition, about 550 officers are now taking the correspondence course provided by the college.

There are also so many other evidences of interest in and appreciation of the kind of work the college is now doing that in my opinion it will not be very long before it will be considered absurd, or worse, to assign to any important positions, ashore or afloat, any officer who has not acquired an adequate knowledge of war, either at the college or elsewhere.

When this becomes the general opinion, it will be considered both an honor and a valued privilege for an officer to be allowed to take the course at the college. In some foreign naval war colleges only those officers are admitted as students who win the privilege in severe competitive examinations; and only graduates of the colleges can be assigned to duty on the staff of a commander-in-chief afloat.

These are very desirable conditions which I feel sure we are fast approaching; and if this is true it behooves all officers who have a just regard for their future careers to prepare themselves successfully to meet these conditions.

With this end in view it is evident that the earlier officers begin the studies in question, and the more they are able to accomplish in the way of acquisition and mental training, the better it will be for them and for the service.

As even indifferent students know, a very little time devoted to a subject each day will result in really astonishing accumulation. Where a number of officers are serving in the same locality, as in the subdivisions of the fleet, in Washington, at naval stations, in the wardrooms of ships, etc., cooperation is facilitated, and results can be accomplished which cannot be achieved by officers working independently.

If, therefore, I have been able to present this case, of the long neglected training of our officers for war, with sufficient clearness to show its imperative necessity, perhaps some may be inspired to take the first steps toward the establishment of what may be called Naval War College Extensions.

If so, I am sure that both the college and the Department would gladly meet them half way, by affording the necessary facilities

and supplying the necessary preliminary instructions. Certain lectures, supplemented by the experience of those of you who have attended the college, would serve to initiate the playing of the strategical and tactical games, and would, beyond question, demonstrate their great practical value much more convincingly than I have been able to do.

In addition to this, if officers should find the time to take up a selected but limited course of military reading, there can be no doubt that in a year's time they would have every reason to congratulate themselves.

The following list of books is suggested as preliminary to a more extended course of reading when opportunity offers. Many similar lists could be suggested, but it is believed that these books will prove not only as interesting as any, but will serve to give a general idea of the nature and extent of the knowledge that is essential to success in war. It is assumed that officers are familiar with the earlier works of Mahan, and with those of Daveluy and Darrieus that have been translated and published in the Naval Institute:

The Brain of the Navy	Wilkinson
Naval Strategy	Mahan
Maritime Strategy	Corbett
Letters on Strategy	Hoenlohe-Ingelfingen
Modern War	Derrecagaix
On War	Clausewitz

A list of the principal works used in the various branches of study at the Naval War College will be sent upon application.

And now, in conclusion, let me point out that the training I have suggested will not impose upon you a task in the ordinary acceptation of the term. It is, on the contrary, a game that is proposed for your entertainment and instruction. It is as thoroughly competitive as football or chess or any other game that involves the conflict of mind against mind; but in addition to the natural interest inherent in all competitive games this particular one is so intimately associated with that which, in playing it, you will soon recognize as one of the most essential elements of maritime power, that it cannot fail to interest you intensely; therefore I can promise you with every confidence that even the limited course of reading and war games herein indicated will prove a revelation. It will not only give you a new point of view; will not only define your real mission in life; will not only lead you to regard

the service in a new and higher light, but will actually transform the daily grind of routine duties in peace into a willing and cheerful service in the cause of preparation for war.

If I have succeeded in convincing you of the importance of an officer keeping his mission always clearly in mind; if you believe that this will cause his ordinary duties in time of peace to assume such a new aspect that his efficiency in all grades will thereby be increased; if you believe that this attitude toward the service will naturally incline a young officer's mind toward the study of the ultimate object of his profession—that is, success when war overtakes us—it follows that every officer should have these ideas thoroughly implanted in his mind, and should pass this instruction along.

I do not advocate the instruction and training of midshipmen in the art of war, but I do advocate very strongly their being given clearly to understand what they are here for, what they are in the navy for, what the meaning of their contract is, otherwise they are more than likely to waste the priceless years during which only habits of study can be formed and knowledge easily acquired.

In this connection, let me briefly relate, as an illustration, my personal experience. Upon leaving the academy in 1880, I had no real conception of my proper relation to the service, and cannot even recall what my attitude was. Probably I had never formulated any. Doubtless for a long time I was not only comparatively useless but perhaps actually detrimental to efficiency.

There was little doing in the navy in those days of old wooden ships and cast-iron smooth-bores. Officers used to return from shore in the 9 o'clock boat and go ashore again in the 10.30. An afternoon drill period would at that time have brought on a mutiny of serious proportions. There was relatively a great deal of leisure. Under these conditions I put in perhaps 12 or 15 years in a variety of reading that had no direct relation to the profession, including the philosophies, political economy, etc. This was of course useful, but certainly not in the line of an officer's mission.

If some officer of experience had explained this matter to my class, if he had accentuated the importance of military studies (and he could have done it in an hour), I am sure we all would not only have performed our duties more efficiently in all grades

but we should, through a gradual accumulation of knowledge, be much better equipped than we are at present.

And, now, a final word to correct a possibly erroneous inference that you may have drawn from what has been said concerning the importance of the training to be obtained at the War College.

I do not wish to convey the impression that it is my opinion, or that of anybody who has attended the college, that the course of 12 months does or can ever provide either adequate knowledge or adequate training. It cannot possibly do so. The most it can do for the untrained man is to give him the uninterrupted opportunity to acquire the basic principles of the art of war and a certain amount of mental training in their application.

Its principal value is in showing such a man how much he did not know when he began, how much he yet has to learn, and what should be the direction and objective of his future studies.

Unfortunately, as applied to an old man, the future is short—the end of the career is close aboard; but how different it might have been if this old man had been pointed fair in his youth; had been given clearly to understand that only through the gradual, thoughtful accumulation of information, throughout a long period of years, can a reasonable mastery of any subject be attained?

Specifically addressing the younger officers of the navy, let me say that you now have the opportunity that can never return. It lies with you to determine whether, when you become old, you will have to regret the wasted years of your youth; whether at that period of life you will find yourselves simply "practical men"—"beefeaters"— or really educated military naval officers.

It will depend largely upon self-instruction and self-discipline. But you must keep clearly in view the fact that, under modern naval conditions, an officer may be highly successful, and even brilliant, in all grades up to the responsible positions of high command, and then find his mind almost wholly unprepared to perform its vitally important functions in time of war.

The appeal to an officer's patriotism and loyalty is of course higher than an appeal to his personal interest, but when the circumstances are such that the pursuit of personal ambition tends in all repects in the direction of efficiency in preparing the navy for war, then it is to be commended and encouraged.

I have tried to make it clear that those of you who do not acquire a knowledge of the art of war and who do not train your-

selves in its application, cannot reasonably hope to be selected for distinguished duties in the higher grades. Also that every officer who prepares himself for such duties is thereby increasing the efficiency of the navy as a fighting organization.

If my career were ahead instead of behind me, I should endeavor to the extent of my ability, and at the earliest opportunity, to acquire as thorough a knowledge of the principles of the art of war as possible, and should neglect no opportunity to train myself in their application by playing competitive war games.

Such training cannot be begun too soon after an officer has acquired a certain amount of experience in the service, and I should consider it commendable in him to use all proper means to obtain orders to the War College.

He is indeed blind to the signs of the times who does not see that new standards of efficiency are rapidly forming in the service; and those who, understanding this, still neglect the opportunity of youth, with its mental flexibility and freedom from responsibility, will have themselves to blame if, when they reach the higher grades, they are not promoted and are relegated to the class of hewers of wood and drawers of water.

In conclusion, let me again state that in inflicting these elementary principles and illustrations upon such experienced officers as compose this class, I have had in mind chiefly their possible influence upon the large number of admirable young officers who are coming up to take their places; for, manifestly, if a knowledge of the art of war cannot eventually be extended to the fleet and the service at large, the college will have failed to accomplish an important part of its mission.

In welcoming you to the college, I feel that you are to be congratulated upon having an opportunity to devote to these important professional studies a whole year quite uninterrupted by other professional duties or responsibilities.

You may be sure that it shall be my object and that of the members of the staff to facilitate your work in every way, and to render your stay as agreeable as possible.

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U. S. NAVAL INSTITUTE, ANNAPOLIS, MD.

AN INTRODUCTION TO THE USE OF NOMOGRAMS OR ALIGNMENT CHARTS

By COMMANDER G. L. SCHUYLER, U. S. Navy

1. One is often struck by the fact that nomograms or alignment charts are coming more and more into general use in engineering subjects. In England they are frequently used in gunnery work. In France they are particularly popular. In the U. S. Naval Service we are beginning to see them. Usually, since they are so simple to work and since they are presented without explanation of their theory, those who use them do not learn the theory of their construction. One may not know where to turn to to study up the matter and may hesitate to show apparent ignorance by inquiring. Since occasionally one might want to make an alignment chart of his own for some special use, it is thought that an elementary discussion of the simplest good all-around form of alignment chart may not be out of place. It is hoped that they will in time be more commonly used in our naval service.

2. After looking over various books in which the subject is treated, we have here put it briefly in the way which seems clearest to us. "Graphical and Mechanical Computation" by Lipka, John Wiley & Sons, is suggested as very suitable for reading by naval officers who may be interested in going beyond this elementary discussion.

3. Suppose we want to multiply two variables x and y to get a product z. The slide rule uses logarithmic scales and affords a ready solution. But consider also the following alignment chart construction (Fig. 1):

At equidistant points a, c and b on the horizontal base line, erect perpendiculars and lay off on the perpendiculars from a and b scales running simply as logarithm x and as logarithm y. Then if using a straight-edge we connect any point on the x scale as h with

a point on the y scale as d, where will the straight-edge cross the z scale? Obviously at a point f, which is the mean height of ah and bd. In other words, cf would be

$$\frac{ah+bd}{2} \text{ or } \frac{\log x+\log y}{2}.$$

It we graduate the scale of z on cb as *half* of the ordinary logarithms, z will be read off as the product of x and y, for $\log z=\log x$

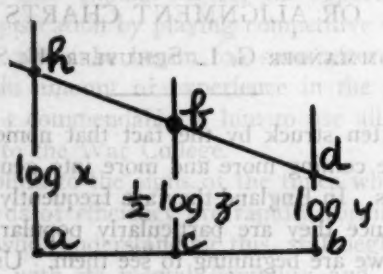

FIG. 1.

$+\log y$, and, by marking off the z scale as one-half of the logarithms of z, we get around the fact that the mean is only half of the sum.

4. Now suppose we had wanted to get not $z=xy$, but $z=x^2y$. Then $\log z=2\log x+\log y$. We want then, in summing up the x

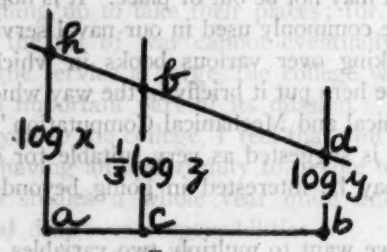

FIG. 2.

and y logarithms, to give double weight to $\log x$. We can do this by making the point c twice as close to a at the foot of the $\log x$ scale as it is to b at the foot of the $\log y$ scale (Fig. 2):

Then $cf=\dfrac{2ah+bd}{3}$ or $\frac{1}{3}(\log x^2y)$; so this time we must graduate the scale for z as $\frac{1}{3}$ of the logarithms of z.

5. So with simple logarithmic scales for x and y, *i. e.*, with both drawn natural size, we must have the ratio $\frac{ac}{cb}$ the same as the desired ratio of the exponents of x and y:

($\frac{1}{1}$ for xy, $\frac{1}{2}$ for x^2y, $\frac{1}{3}$ for x^3y, and $\frac{1}{4}$ for x^4y, etc.)

6. But in going from simple products to products involving powers of x and y, there is an alternative method. Instead of sliding c over twice as close to the x scale to give logarithm x twice the weight in the sum, we may get this same effect by leaving c still in the middle of ab, but making the x scale twice as large as formerly, or as $2 \log x$. In this case (Fig. 3) $cf = \frac{2 \log x + \log y}{2}$

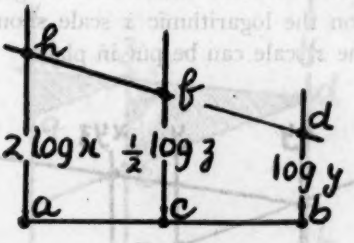

FIG. 3.

and we have then only to graduate the z scale as half the logarithms of z to make this sort of alignment chart work.

7. The foregoing is not a proof but is just a preliminary glance over the matter to illustrate the nature of the nomograms so as to have an understanding of them in mind while proving the constructions for the more general forms like $kx^ly^mz^n$, etc.

8. Such alignment charts as these are really only logarithmic scales summed up graphically with the weights of the exponents of the variables or, what is the same thing, with the values of the coefficients of the logarithms in the sum of the logarithms, taken care of by either of the following methods:

(1) A shifting of the position of the intermediate scale z, or

(2) An increase in the size of units used in plotting the logarithmic scales of one or both of the variables x and y.

Or, we may use both (1) and (2) at the same time, especially if it is desirable to make the scales of more convenient lengths. If, for instance, x has only half the range of y, it would be better to use the method of Fig. 3 and plot the logarithm x scale double size

rather than to leave its scale of inconveniently short length while merely shifting the z scale closer to it (as in Fig. 2). Convenience of scale length is a governing factor and one can suit himself.

9. Now about any constants in the formula. It seems that since we are dealing with logarithmic scales, everything we have said still holds even if constants come into the formula. For a bodily vertical displacement of the logarithmic z scale will take care of all the constants connected with z. We will find that we can lay off the x and y scales so that the extreme values are at the top and at the bottom (with each scale 10 inches long); next carefully locate where the z scale comes between the other scales. Then we need construct only one point on the z scale to get the proper origin for the scale of z. With this and with a knowledge of how far apart the graduations on the logarithmic z scale should be spaced, the graduations of the z scale can be put in place.

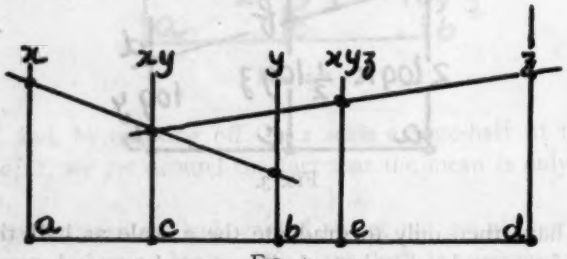

FIG. 4.

10. If one wishes to make an alignment chart for three factors he can first make one for two factors (scales a, c, b in Fig. 4):

The point P on the c scale (often called the "support") gives the product of the first two. Then this is considered as the start of another similar nomogram, the scale at d carrying the next factor z. The product of xyz is read off of scale e. And one can extend this process to any desired number of factors. Support scales need not be graduated as the partial products shown on them are not needed in the work.

11. By adjusting the horizontal intervals between the scales and by adjusting the size of the logarithmic graduations on the scales, x, y and z can be given any desired exponents and the scales themselves can be made any desired length (10 inches for all is a good value). We can have division alignment charts as well as multiplication alignment charts, for if in Fig. 1, where $z=xy$, we reletter interchanging y and z, we have $z=\frac{y}{x}$. Or we can lay a

logarithmic scale off the other way, *i. e.*, from top to bottom, to take care of a negative exponent. In fact one can handle any expression like $Kx^ly^mz^n$, etc., where the exponents are fractional or negative, or anything he likes to make them, and where the number of factors like xyz is as great as one pleases.

12. There are literally hundreds of different forms of alignment charts. But when studied, this particular form proves to be of extreme generality. It has therefore been selected as the illustration with which one can best introduce the subject to those unfamiliar with alignment charts and their construction.

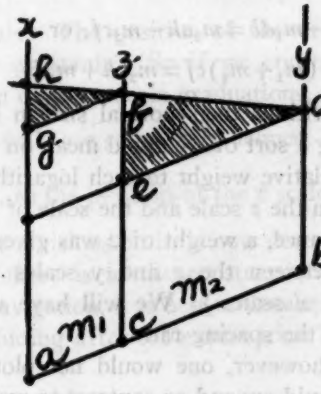

FIG. 5.

13. If we have three parallel axes as ah, bd and cf (Fig. 5) carrying scales for x, y and z, it is of great interest to know how the lengths of the intercepts are related in terms of the spacing ratio $\frac{m_1}{m_2}$ between these axes. For with this knowledge we can give what relative weight we desire to the other scales in reading off a weighted sum of the x and y logarithms on the z scale between them. We can get the idea from rereading paragraph 4, but, to show it more generally, we have, in Fig. 5, made acb a transversal instead of a horizontal base line. We will be interested to find how this proof shows the different scales can without complications be moved up or down to get them opposite each other for convenience.

14. If we make de and fg parallel to acb, the triangles fgh and def are similar. Then the ratio

$$\frac{hg}{fe} = \frac{hf}{fd} = \frac{ac}{cb}. \tag{1}$$

And we can call the ratio $\frac{ac}{cb} = \frac{m_1}{m_2}$ and consider this the spacing ratio into which the z scale divides the interval between the x and y scales.

15. From (1)

$$\frac{m_1}{m_2} = \frac{hg}{ef} = \frac{ah-ga}{cf-ec} = \frac{ah-fc}{cf-db}. \tag{2}$$

Therefore, $m_1cf - m_1db = m_2ah - m_2cf$, or

$$(m_1+m_2)cf = m_2ah + m_1db. \tag{3}$$

So if we plot logarithms their normal size in both scales in this way, then in getting a sort of weighted mean on the z scale we find we have given a relative weight to each logarithm proportional to the interval between the z scale and the scale of the other variable. (In Fig. 2, for instance, a weight of 2 was given to log x by making the interval between the z and y scales twice the interval between the z and x scales.) We will have weighted the logarithms inversely as the spacing ratio.

16. In general, however, one would not plot log x and log y normal size, but would expand or contract to make them fill up the desired lengths. Then one can select the spacing ratio $\frac{m_1}{m_2}$ for locating the z scale in such a way as to take care not only of the scale enlargements used, but to take care, at the same time, of the exponents desired for x and y. To get at this sort of construction we may first place equation (3) in proper form for direct addition of scales by dividing through by m_1m_2 to get the following:

$$\frac{fc}{\frac{m_1m_2}{m_1+m_2}} = \frac{ah}{m_2} + \frac{db}{m_2}. \tag{4}$$

Then the intercept on fc (the z scale) will represent the sum of the intercepts ah (on the x scale) and db (on the y scale), provided we select, on the appropriate scales, moduli proportional to these denominators in (4). If this is done, everything is kept

clear and we will be virtually adding the logarithms of whatever powers of x and y we select and getting direct answers in the product.

17. So, therefore, after plotting $\log x$ on the x scale to some convenient size which will make the scale the desired length, we examine to see how many times we have enlarged the logarithm of the function of x to increase it so as to give the scale actually laid off. We call this modulus m_1. For instance, if we wanted to have $(x)^{\frac{1}{3}}$ appear in the product and have multiplied $\log x$ by 5 to get a convenient 10-inch length for the x scale, then m_1 is 15. Similarly one obtains m_2. Then m_3 the modulus for the z scale has to be $\frac{m_1 m_2}{m_1+m_2}$. This defines the amount of enlargement of $\log z$ on the z scale. The position of the origin of the z scale depends upon the constants. So if we construct one point and calculate the origin of the z scale graduations, the positions of the divisions on the z scale are completely defined. Also ac is $\frac{abm_1}{m_1+m_2}$ and cb is $\frac{abm_2}{m_1+m_2}$, so the position of the z scale, as well as the size and location of the divisions on it, is now determined.

18. This is all there is to the construction of such alignment charts but, as in navigation, it is best to develop the ability to apply the theory by including after the explanation an illustrative practical example.

19. *Example.*—

$$w=472(x)^{.42}\,(y)^{1.25}\,(z)^{.75}, \qquad (5)$$

and let us say x varies from 1 to 8, y from 30 to 40 and z from 100 to 3500. First it will be determined what multipliers are needed for the logarithms to give 10-inch scales:

	Maximum	Maximum	Log max.	Log min.	Difference	Multiplier for logs to give a 10″ scale
x	8	1	.903	.000	.903	11.1
y	40	30	1.602	1.477	.125	80.0
z	3500	100	3.544	2.000	1.544	6.5

This can be done with sufficient accuracy on the omnimeter or on the slide rule. It will be seen that if we had used the same multiplier for $\log x$, $\log y$ and $\log z$, we would not have efficiently

utilized the full available length of all the scales. It is not necessary to insist upon all scales being precisely 10 inches long (or any other exact length for that matter). 11, 80 and 6 are sufficiently accurate and are the more convenient multipliers which will be used.

20. Sometimes specially printed logarithmic paper scales are used for putting the graduations in place. These, by folding, can be made to show logarithms in any degree of enlargement, but they are not quite so practicable as they sound. Also they are not necessary and it will be assumed that the reader has none but will use computation instead.

21. There should be, say, 20 divisions calculated on each scale. For each variable the logarithms of about that number of equidistant values are picked out and the work carried through in the manner shown by the following skeletonized tables. In the third table it is desirable to insert a certain number of extra values in the part of the scale where the spacing is inconveniently large. The fourth column is obtained by subtracting the initial value in the third column from each of the other figures in that column.

TABLE I (x scale)

x	Log x	11 log x	11 log x − 0
1.00	.00000	.00000	.00
1.25	.09691	1.06601	1.07
1.75	.17609	1.93699	1.94
....	.....	.....	....
....	.....	.....	....
7.50	.87506	9.62566	9.63
7.75	.88930	9.78230	9.78
8.00	.90309	9.93399	9.93

TABLE II (y scale)

y	Log y	80 log y	80 log y − 118.16960
30.0	1.47712	118.16960	.00
30.5	1.48430	118.74400	.57
31.0	1.49136	119.30880	1.14
....	.....	.....	....
....	.....	.....	....
39.0	1.59106	127.28480	9.12
39.5	1.59660	127.72800	9.56
40.0	1.60206	128.16480	10.00

TABLE III (z scale)

z	Log z	6 log z	6 log z—12
100	2.00000	12.00000	.00
150	2.17609	13.05654	1.06
200	2.30103	13.80618	1.81
250	2.39794	14.38764	2.39
300	2.47712	14.86272	2.86
400	2.60206	15.61236	3.61
500	2.69897	16.19382	4.19
700	2.84510	17.07060	5.07
...	.....	.....	....
...	.....	.....	....
3100	3.49136	20.94816	8.95
3300	3.51851	21.11106	9.11
3500	3.54407	21.26442	9.26

22. The computation of the moduli for the scales is as follows:

$$11 \log x = 26.2 \log (x)^{.42} \qquad m_1 = 26.2,$$
$$80 \log y = 64.0 \log (y)^{1.25} \qquad m_2 = 64.0;$$

so for the support scale

$$\frac{m_1 m_2}{m_1 + m_2} \qquad m_3 = 18.51,$$

$$6 \log z = 8 \log (z)^{.75} \qquad m_4 = 8.00;$$

and for the w scale

$$\frac{m_3 m_4}{m_3 + m_4} \qquad m_5 = 5.59.$$

23. The next step is to arrange the horizontal spacing of the scales. We will place the x scale on the left, the y scale 7 inches and the z scale 8 inches over to the right. This sort of wide spacing of the y scale gives more room between scales in working the alignment chart and makes the straight-edge cut intermediate scales less obliquely. The support scale should be $7 \times \frac{m_1}{m_1 + m_2} = 2.03$ inches to the right of the x scale. The remaining space over to the z scale is 5.97 inches. So the w scale is located $5.97 \times \frac{m_3}{m_3 + m_4} = 4.08$ inches to the right of the support scale, or 6.11 inches from the extreme left.

24. We can therefore lay these out as in Fig. 6. If we calculate the point for the bottom of the w scale ($x = 1$, $y = 30$, $z = 100$) the value of 1, 048, 000 is obtained. Its logarithm, times 5.59 or 33.65370, must therefore be subtracted from $m_5 \log w$ in laying

off the z scale. If we work out the top of the z scale from the maximum values of all the variables ($x=8$, $y=40$, $z=3500$) $w=51,742,500$ is obtained. It should be 9.48 inches up the scale from construction, and this checks with the value obtained by computing it like the other points on the w scale. A tabular form, similar to those of paragraph 21, is used in computing the w scale.

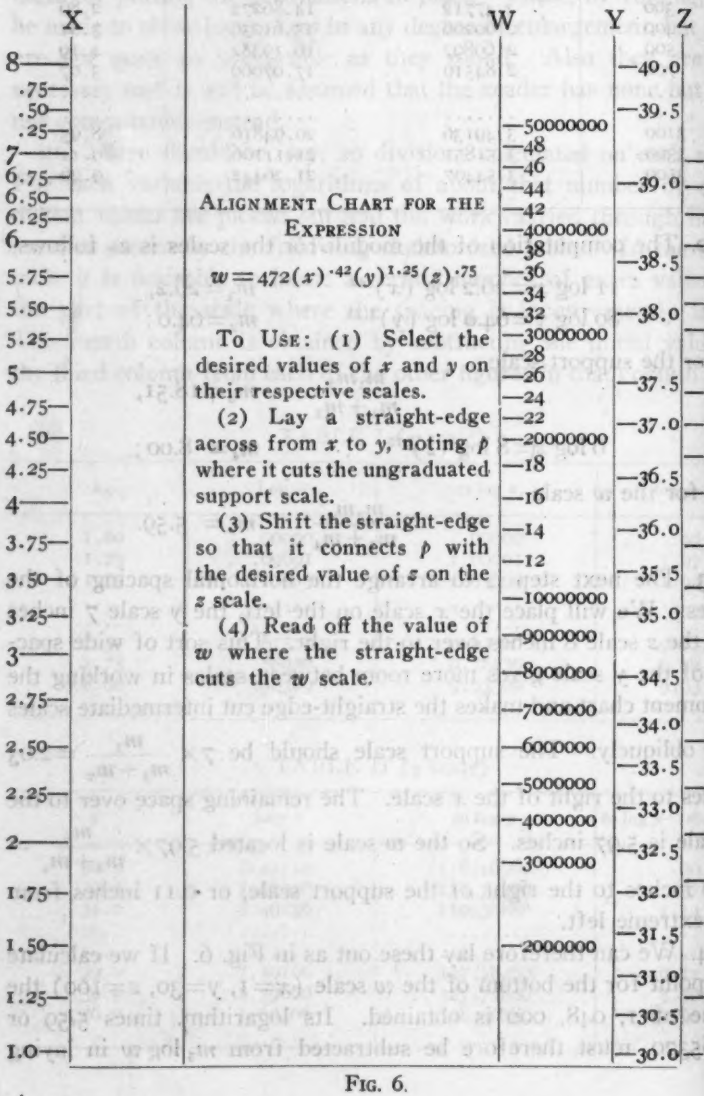
X
W
Y
Z
ALIGNMENT CHART FOR THE EXPRESSION
$w=472(x)^{.42}(y)^{1.25}(z)^{.75}$
To Use: (1) Select the desired values of x and y on their respective scales.
(2) Lay a straight-edge across from x to y, noting p where it cuts the ungraduated support scale.
(3) Shift the straight-edge so that it connects p with the desired value of z on the z scale.
(4) Read off the value of w where the straight-edge cuts the w scale.

FIG. 6.

25. The alignment chart shown can be defined as follows:

Scale	Distance from left edge	Scale graduations
x	.00	$11 \log x - 0$
y	7.00	$80 \log y - 118.16960$
$\overline{\quad}$	2.03	$\overline{\quad}$
z	8.00	$6 \log z - 12.00000$
w	6.11	$5.59 \log w - 33.65370$

26. In using alignment charts the full lines need not be drawn across in the construction, as only short pencil marks where the scales are crossed are necessary. Or else we may use a pin pushed into the paper to mark accurately where the straight-edge crosses a scale. Fig. 6 is necessarily shown reduced in size. Practically any requirements in the way of alignment charts can be readily met by studying Lipka's book or other similar works, but it is thought desirable to confine this article to a description of and an introduction to the subject and to give, though in considerable detail, but a single illustrative example.

NAVIGATION NOTES

By COMMANDER J. F. GREEN, U. S. Navy

ERRATA

On page 75, in the Interval to Noon equation, the signs of the denominator factors representing change in longitude due to speed and that due to current should both be plus. As this affects slightly all subsequent calculations the following solution should be substituted therefor:

Interval to noon $\frac{984.35}{900+7.5+.87} = 1.0836$

$= 1^h\ 05^m\ 01^s$

W. T. 11 00 00

W. T. of L. A. N. 12 05 01

Run from 11 a. m. (by watch) to L. A. N.

Course	Dist.	l	p	D
150°	13	11.3	6.5	8.1

Lat. (Nav. Pos.) 11.00 a. m. 37° 05′ 54″ N.

l 11′ 18″ S.

Lat. (Nav. Pos.) L. A. N. 36° 54′ 36″ N.

L_o 37°

Long. (Nav. Pos.) 11.00 a. m. 72° 23′ 45.3″ W.

D 08 06.0″ E.

72° 15′ 39.3″

Current in Long. 1.084 × .87 56.6 E.

Long. (Nav. Pos.) L. A. N. 72° 14′ 42.7″ W.

Noon constant. True Lat., and Long., at L. A. N.

	h m s			° ′ ″	
L. A. T. of L. A. N.	0 0 0	I. C.	(−)	0 01 00	
Long. (Nav. Pos.) L. A. N.	4 48 58.8	T. 46+		10 22	
G. A. T. of L. A. N.	4 48 58.8	Sub c	(−)	08	
Eq. T.	(−) 3 48.5	C		00 09 14	
G. M. T. of L. A. N.	4 45 10.3	$90+d$		108 40 12	
		K		108 30 58	
⊙ Dec.+	° ′ ″ 18 40 12	h obs.		71 38 00	
	90	Lat. true		36 52 58 N.	
$90+d$	108 40 12	Lat. (Nav. Pos.)		36 54 36 N.	
App. Lat.	36 54 36	Δ Lat.		1 38 S.	
App. Alt.	71 45 36				

	° ′ ″
Long. (Nav. Pos.)	72 14 42.7 W.
Δλ for Δ Lat.	10.9 W.
Long. true	72 14 53.6 W.

DISCUSSION

Promotion in the Navy

(See Page 7, Whole No. 215)

Commander R. A. Koch, U. S. Navy.—Lieut. Commander Vossler has outlined briefly the three systems of promotion which have been tried in the navy and recommends a fourth as a combination system. Commander Foote states there are only three distinct methods and agrees with Lieut. Commander Vossler. (It is true that any method may be classed in one of these three methods, but there are many methods of application.) Commander Barker states the simple fact that in any scheme a large number of useful officers will be transferred to the retired list or a hump will result and that Lieut. Commander Vossler accepts the hump. (The prevention of the hump has been the reason back of all proposed systems.)

The three systems which have been tried are condemned. The system suggested by Lieut. Commander Vossler is by far the worst system that has yet been suggested as it does not relieve the hump and puts the mass of officers in a position where promotion to higher grades is out of the question, it would tend to kill initiative, energy, mutual confidence, team work, *esprit de corps* and would lower the general average ability.

The Navy Requirements for maximum efficiency are:

(1) High average ability.

(2) Promotion to the various grades at a suitable age to get all out of an officer there is in him.

(3) Selection to duty and assignment in accordance with special qualifications.

(4) *Esprit de corps,* team work, initiative, mutual confidence.

The navy now has the first requirement. In order to have the second requirement, there must be elimination, which will aid progressively the attainment of the first requirement. The third requirement is now within the power of the navy and is used to a greater or less extent; however, the navy being under-officered, availability must be given too much weight in assignments to duty. The fourth requirement is the most important and can never be obtained by any process of hurdling or rehurdling, where jealousies must enter and where officers will be tempted, in order to reach higher grades quickly or to prevent themselves from being hurdled by juniors, to use such methods as self-advertisement or to assume all credit for success obtained in any activity, although this success may be obtained in great part by the initiative and efficient work of subordinates. In order for the navy to keep both the second and fourth requirements, it is necessary that officers go up or out. Those who go up will have at

least slightly higher average ability than those who do not and will contain the *stars* required in the various activities, who will by the operation of (3) be in positions such as Chief of Staff or positions without title where their ability is felt, or in minor commands, but they will not function as stars of the first magnitude until they reach the proper age; this preliminary work will only test and increase their powers, give them increasing responsibility and prepare them for their final rôle.

The plan to carry out the above is in no sense original and is no doubt now in the files of the Navy Department worked out in detail by the late Admiral John Hood, who was a captain on duty in the General Board in 1912 when he had the task of preparing a plan for promotion. He had available all data and suggestions and had the necessary assistance. Promotion by lot to various grades to eliminate the hump had even been suggested. His plan was given little consideration due to the fact that a plan was required that would increase efficiency with no increase in cost. Captain Hood, however, made use of retired officers as will be briefly outlined, and he also pointed out that officers with 14 years' service would be the best nucleus of a reserve force that could be obtained. The additional expense of this limited number of retired officers would be a small item of the expense of a Naval Reserve Force now generally recognized as a necessity.

BRIEF OUTLINE OF CAPTAIN HOOD'S METHOD OF PROMOTION

A certain number of officers graduate from the Naval Academy. The number of graduates to be commissioned may later be reduced when the navy has its authorized officer complement. Warrant officers commissioned with a class will for promotion purposes be considered as a part of that class. Three years after graduation this class is due for promotion to lieutenant (j. g.) and six years after graduation to lieutenant. Fourteen years after graduation this class comes up for lieut. commander.

Selection here enters after 14 years' service, in which time all officers have had an opportunity to develop. The average loss up to this time resulting from death, court-martial, resignation, and failure to pass examinations was given in the original plan. Of those remaining in the class, a certain number or percentage are selected to fill the lieut. commander grade (there was, I believe, some slight elasticity in the number of this grade), the remainder will automatically retire on three-quarters pay. The term selection is used instead of elimination as the attitude of the board should be that of selection. Officers might be selected for initiative shown, work accomplished, and responsibility assumed, whereas, if ordered to pluck, a board might be on the defensive in its actions and these same officers might be plucked; letters of censure or failures recorded serving as a reason or excuse. It was not claimed that the best would always be selected up any more than it can be claimed that class standing indicates accurately the true knowledge obtained at the Naval Academy but it approaches service standing as Naval Academy standing approaches academic standing.

This process is continued in each grade after a definite number of years' service in grade. This one class can be followed through to the rear admiral grade where probably only about two are selected. The average age of reaching the grade of rear admiral was, I believe, 55. There was no penalty for entering the Naval Academy a year or two above the average age except that if selected to rear admiral it would be at an age of 56 or 57, instead of 55. This is a survival of the fittest with a vengeance but there is no hurdling or re-hurdling and no stigma or hardship attached, but as an asset a wonderful reserve nucleus is created.

USE MADE OF RETIRED OFFICERS OTHER THAN IN THE RESERVE FORCE

Captain Hood outlined certain shore duties that might be assigned to retired officers upon their request. This included recruiting stations, hydrographic offices, navy yards, and many important duties; supervision over all activities was, however, left in the hands of active officers. By this method, the number of officers could be increased at under officered stations and many active officers could be released for other duty. A retired officer would perform active duty on shore only and only at his own request, the incentive for a retired officer to ask for this duty would be his interest in the duty and its permanency, he could have a regular home of his own which would greatly decrease expenses and he would be allowed to take short cruises to keep in touch with the navy afloat. At the end of about 20 years it was estimated that all duty to which retired officers might be ordered would be filled by them, and the question of shore duty for active officers would present itself. Captain Hood approved of definite tours of shore duty for active officers and pointed out that there were many billets on shore open only to active officers and further pointed out that there is no limit to postgraduate courses for junior officers or war college courses for senior officers and that it would be practically impossible to give officers sufficient postgraduate and war college work unless a large per cent of shore billets were taken by retired officers.

I have not gone into details but as near as I can remember the above was Captain Hood's plan which was worked out in minute detail and is no doubt available and is as applicable now as when written. This plan was probably the most carefully worked out of any plan ever suggested. Its only criticism being that it would cost more money than some other plans but as previously stated this excess of retired officers would form a small part of the present reserve force which of necessity must be expensive, but is recognized now as essential.

Naval Aviation and a United Air Service

(SEE PAGE 307, WHOLE NO. 217)

CAPTAIN RALPH EARLE, U. S. Navy.—The placing of all aviation under the misleading and catch word title of a united air service has been for some time and still is a very seriously discussed measure. Such a proposed organization would actually instead of uniting anything rob the

army and navy of a very vital part of their power by adding a new and independent force to our fighting arms with all the multitudinous interferences and complexities involved thereby. Such procedure is akin to robbing a person of the use of one arm by having its movements controlled by a brain over which he had no authority. Instead of unity of action there would result in every conceivable operation dual control. A military or naval undertaking cannot succeed save only under one commander.

I wish that all those who may have the responsibility for deciding finally whether or not the United States should have a united air force would place themselves, prior to making such a weighty decision as an orientation point from which to consider the various arguments pro and con, in the dark days of late March, 1918, when the great offensive of the German Army began on the 50 mile front from Arras to La Fere. Can they believe that divided control of the Allied forces would ever have beaten that host? Not until some time after Marshal Foch was chosen as the Allied Commander-in-Chief under date of April 3d did the checking of the German onrush become a fact, and the counter offensive begin that October 1st caused German leaders to make frantic efforts for an armistice; and who believes to-day, but what that, if it had not been for the unity of command so fortunately decided upon, the result of the war would have been far less satisfactory to us. This unity of command included control of all the air forces operating with the armies.

A united—What a clever way of spelling divided!—air force? By all means, *No*, never. Remember the lessons of those dark days. Unity of military command, and in that command, unity of action are clearly indicated and must be conserved. An air force that cannot operate with, or in other words is not an integral part of either an army or a navy is not worth while possessing. Before a force can be a unit, the members thereof all must be truly a part of it in doctrine, training, and understanding. The captain of a battleship must know his gunnery officers and their capabilities as developed by association with him if he would shoot accurately, similarly he needs to have his aviators be they scouts or spotters or torpedo plane pilots or what not speaking his language and so each carrying out his mission to the full. It must be apparent to all that the pilot of a seaplane or plane scouting for the navy who is not a seaman, and thus understanding naval tactics and the uses of types of sea forces, is *of little* real value to the commander at sea.

I do not believe that one can truthfully say that the formation in Great Britain of a united—*i. e.*, the Royal—air force has been a success, or that it ever was a success even though all of us will cheerfully admit that Sir William Weir, its first head, was an exceptionally capable man. The formation of this force led to many promotions in rank but hardly to advancement in efficiency of the air services. In fact progress seemed to stop then and there. We recollect that almost immediately after formation of the Royal Air Force in 1918 the British Navy was compelled to organize a separate navy air force in order to be enabled to

carry out operations in the Dunkirk area. Then again did not their navy have to operate lighter-than-air craft at that period and independently of this main organization? Surely these facts indicate something amiss with united control of air forces.

The fallacy of the argument so often used that it would be economical and for the best of military and naval interests to combine the production of machines under one organization is exceedingly well brought out by Captain Craven. Seaplanes and land planes are certainly dissimilar and becoming more so as time goes on. So different are they that one cannot conceive of one organization producing all types efficiently. A big organization is too unwieldy. All such are hard to start, and at the same time, once started are difficult to stop even though headed straight towards dire disaster, such is their momentum. Overhead costs then become enormous, conferences and counter conferences, orders and disorders become the rule of the day. No sailor knows all about the soldier's job and the converse is true. Entire amalgation is beyond the realms of possibility.

There is a tendency to misread certain arguments or statements usually critical of the lack of progress made along certain lines by attributing such to navy—or army—conservatism. Difficulties are encountered in all development, but to attempt to overcome them in a manner akin to that of increasing the number of inexperienced cooks engaged in making a broth which all admit doesn't help the broth at all, is most illogical. A united air service will multiply the men, civilian office holders and others, necessary to get results by hundreds, and, as they will try to cooperate by conferring with sailors or soldiers, the number of the latter also must be increased to permit such procedure. No economy in such methods!

An unbiased thinker surely must agree with Rear Admiral Adair when he remarks in his strictures on the operations of the Royal Air Force in the House of Commons, December 10, 1919, after reciting its many shortcomings—"I would go so far as to say this, that, had the progress of the Naval Air Service been left to the hands of the Navy, the German Fleet might have been destroyed in Wilhelmshaven long before the armistice. That is rather a severe charge to make, but I think it is one that is justifiable." In other words a third arm, that can never appreciate the conditions peculiar to the other two, is and must always be an obstacle to progress. The navy must control the surface of the sea, all the waters below and the skies above. This conception of course is not new, it is what I believe the navy has always stood for, and should continue to insist upon. Possibly a sailor should not speak of the army and its aircraft as he cannot be supposed to be as competent to manage such, as are army officers, nor does he have to; as, fortunately both General Pershing and Field Marshal Haig have given views upon the undesirability of a united air service in language and positiveness that leave nothing to be desired. Their views are made available to us in Captain Craven's article and merit all consideration.

We now have no cabinet post for the commissioner of automobiles to take care of those machines operated by civilians, nor do we need a

cabinet officer to care for such aircraft as may be privately owned and operated. Their proper control will come coincidently with their use.

Statements as to lack of progress are usually too vague and so unfair as to hardly merit answering in detail. Despite all critics there has been great progress in all branches of aviation; far greater than advocates of a united air service are willing to admit and which the services themselves cannot in reason disclose or give publicity.

The last paragraph of Captain Craven's article is indeed expressive and sums up the situation tersely and should be read by those who may eventually decide the great question at issue. By observance of its precepts and by the emphatic rejection of a united air service great saving in expenditures and real progress and actual leadership in the air will be our country's portion.

LIEUT. COMMANDER W. A. EDWARDS, U. S. Navy.—Captain Craven, in his admirable article, "Naval Aviation and a United Air Service," hits the nail squarely on the head when, in conclusion, he states that:

"In view of the definite opinions publicly expressed by leaders in the great struggle of the recent past, it is obvious that advocates of the United Air Service, if acquainted with actual conditions and requirements, are basing their arguments in favor of such an organization on other than military grounds."

If these advocates of a United Air Service are not acquainted with "actual conditions and requirements," then their testimony is of no value, and they should be disqualified and eliminated forthwith as incompetent witnesses.

If, however, they are familiar with "actual conditions and requirements," it is perfectly obvious, as Captain Craven tritely remarks, that they are basing their arguments on other than military grounds.

Can it be possible that the dazzling rays from the "brass hats" contemplated in the proposal to create a United Air Service, consisting of a secretary, an assistant secretary, 1 major general, 15 brigadier generals, 165 colonels, 300 lieutenant colonels, 605 majors and 3850 officers of the lower grades, have so blinded these advocates of a separate service that they cannot see the unsoundness of their arguments from the point of view of the efficiency of the battle fleet?

We are constantly reminded by those who favor amalgamation of the fact that Great Britain amalgamated her two air services during the war with unqualified success and that, therefore, we would be well advised to do likewise. It is, of course, quite true that Great Britain did amalgamate, but with what measure of success still remains to be seen. Captain Craven remarks in this connection: "Rumor has it that all is not plain sailing," etc. We are not concerned for the moment, however, with the success or the failure of the British problem, for the fact remains that Great Britain was fully justified in taking this step when she did for a great many very excellent reasons, none of which, however, apply in the remotest degree to us. In the first place, the fusion of the Royal Naval

Air Service and the Royal Flying Corps into the Royal Air Force was not effected until April, 1918; or, in other words, and this is the meat of the argument, not until after the German High Seas Fleet had been contained, and not until after the submarine menace was overcome to such an extent that the world's output of shipping exceeded the destruction occasioned by the submarine menace. The production and destruction curves crossed in March, 1918. In other words, the situation at sea was well in hand by the time this fusion took place, and, although the naval war had not been won, the navy had already accomplished its primary mission and the freedom of the seas was assured to the Allied cause.

Now, what was the strategical situation on land at that time—April 1, 1918?

Admittedly, it was far from being satisfactory, and I do not think that it is any exaggeration to say that it was critical. What, therefore, could have been more natural, more imperatively logical, than the action taken by Great Britain in reinforcing her hard-pressed armies on the various fronts, with the supernumeraries of her naval strength—the Royal Naval Air Service? The situation was critical. The immediate mission was to win the war at all costs and with a disregard of post-war or any other consequences; and the most expedient way was by amalgamating the two services.

This international emergency situation is paralleled on a minor scale by that of our own Northern Bombing Group with reference to which the Commander of the U. S. Naval Forces Operating in European Waters estimated as follows, in the early fall of 1918:

"Enemy have evacuated naval bases in Flanders; the mission for which the U. S. Naval Northern Bombing Group was organized is therefore accomplished.

"The proposition of employing this unit in Italy has been actively under way for some time, but several months must elapse before operations there can begin.

"Consideration has also been given to the project of continuously bombing enemy naval bases in the Heligoland Bight, but for this purpose planes of greater radius and greater carrying capacity than are at present available must be built and equipped. A considerable interval of time must be allowed before this can be effected.

"The personnel necessary for the above-mentioned undertakings has, after six months of unremitting labor, been obtained and organized into an operating unit, which, if disbanded at this time, would be most exceedingly difficult to reconstruct. In the present emergency, therefore, which is felt by everyone to mark the crisis of the war, it is most urgently represented that it is the duty of the Navy Department, in consideration of the foregoing, to depart from the principle laid down that navy personnel should only be used against purely naval objectives and that the services of the U. S. Naval Northern Bombing Group be offered to the Commander-in-Chief of the American Expeditionary Forces, to assist in hastening the victory which is impending.

"It is moreover definitely determined in the event of the above change of objective being agreed to by the department that preparations shall continue unremittingly, (a) to prepare an offensive operation against enemy naval bases in the Adriatic; (b) to prepare an offensive against the German North Sea coast, either with more powerful machines, or, in the event of a military situation, allowing of a nearer approach to Germany with the present types of machines. As soon as the preparations for either of the above objectives permit, the U. S. Naval Northern Bombing Group shall at once be withdrawn from army work and returned to naval work."

If this constitutes a sound argument for the permanent amalgamation of our air forces, then there exists an equally sound argument for the amalgamation of the army and the navy into a United Defense Service.

The fundamentally basic principle of warfare is that unity of command is essential to success; conversely, divided control spells disaster.

There can be absolutely no doubt that, in the next war, the Fleet Air Force will be just as much an integral part of the fleet as the submarine force or the destroyer force, if not, indeed, more so. As such, it must remain under the control of the commander-in-chief not only during battle, but during the pre-war period of preparation for hostilities.

In commenting upon the Royal Air Force in "The Crisis of the Naval War," Admiral of the Fleet, Lord Jellicoe, asks these questions:

"With the air service under separate control, financially as well as in an executive and administrative sense, is it certain that the Admiralty will be able to obtain machines and the personnel in the necessary numbers to carry out all the experimental and training work that is essential for efficiency in action? Is it also beyond doubt that unity of command at sea, which is essential to victory, will be preserved?"

Let us apply these exceedingly pertinent questions to our own situation and look at the problem from this point of view.

What is the answer?

The answer is no.

CHIEF CONSTRUCTOR D. W. TAYLOR.—The question of a United Air Service, or as I think it should preferably be called, an Independent Air Service, has been a good deal discussed in the last year or so, and apparently the discussion is going to continue. The matter is one of primary importance, affecting the national safety, and an incorrect decision in the next year or so will do harm which will take years to overcome.

Questions of material in this connection are, it seems to me, though serious, of minor importance compared with some fundamental questions involved.

I have heard a good deal about the alleged excessive overhead due to separate services; but the advocates of an Independent Air Service make no mention of the obvious fact that the expense of the necessary liaison between an Independent Air Service and the army and navy would be much greater than any possible reduction of overhead by amalgamation. The

mere fact that army and navy machines both fly does not mean that they should be identical. Captain Craven makes this very clear. The fact is that the general situation as regards material is very fairly comparable to the ordnance situation in the army and navy.

Apart from material matters, there are at least two fundamental objections to an Independent Air Service based upon human nature—a thing which changes very slightly if at all from generation to generation. Suppose we had an Independent Air Service handling all aviation. That air service, being manned by humans, would naturally and inevitably concentrate upon the offensive side. It would deceive itself and deceive the country as to its offensive capabilities. Only by exaggeration in this respect could it get money from Congress in competition with the army and navy. From the naval point of view, while the offensive is of major importance, adequate defense in the air against the enemy's offensive is also essential. Until human nature has changed, the navy would have no such defense at its service with an Independent Air Service and would be at a most serious disadvantage in dealing with a navy which had a properly balanced air service branch.

Another fundamental objection of the same kind to an Independent Air Service is touched on by the author. History has shown that combined operations of the army and navy have always been carried on with greater difficulty and less efficiency than independent operations of either arm. Of course it is easy to say that this should not be so, but it has been so in the past, and will continue to be so until human nature manifests itself differently from its manifestations in the past. Now with an Independent Air Service, every operation of the army and navy in war will be a combined operation so far as we can estimate at present. At least this will necessarily be the case if aviation develops as we all believe. The resulting inefficiency inevitable in combined operations would be a most serious handicap upon both the army and the navy. Almost certainly the result of an Independent Air Service would be in time that we would consolidate army, navy and air service under one head—a Minister of Defense. We should then be exactly where we were in 1789, when the Secretary of War (not Secretary of the Army) controlled both army and navy. This arrangement lasted nine years, and during this period there was much criticism of the administration of naval affairs. Early in 1798 an investigating committee of Congress reported that apparently enormous expenses and unaccountable delays had attended the naval administration of the War Department. So the Act of April 30, 1798, established the Navy Department.

If we establish an Independent Air Service, the next step will be a Minister of Defense. Then, after the same troubles as from 1789 to 1798, we will again divide into the army and navy. In my opinion the ultimate result of an Independent Air Service would be that in from 5 to 15 years after its establishment we would have again the same organization as to-day.

The Fate of the Dreadnought

(SEE PAGE 191, WHOLE NO. 216)

LIEUTENANT F. S. LOW, U. S. Navy.—In the article, "The Fate of the Dreadnought," published in the February PROCEEDINGS, it seems indeed very fortunate that the authors did not permit their assumptions concerning the characteristics of various types of ships to lead to any definite conclusion as to the course that will be followed by naval architects. This statement is made because it appears that many of their suppositions and statements of fact are not only at variance with accepted practice but also with every theory we have derived from research and experience. The discussion is based upon such faulty premises that were not these errors pointed out, many readers not only might, but undoubtedly would, receive an extremely misleading conception of fundamentals which have to do with the construction and operation of submarines.

The distinction drawn by the authors between a submarine and a submersible is no longer acceptable. To quote Monsieur Laubeuf the originator of the submersible. (*Le Yacht*, Janvier, 1910.)

"The difference consists in the form, the method of construction and the buoyancy. The pure submarine has circular cross-sections and a hull in the form of a cigar; the ballast tanks in the interior of this hull and reserve buoyancy is small.

"On the other hand, the submersible has a form which approaches that of an ordinary ship and the cross sections are not circular; it possesses a double hull in whole or in part, the ballast tanks being formed by the space between the two hulls. The reserve buoyancy is great."

As a matter of fact, due to the great strides made in submarine construction in recent years and to the application to one type of ship of so many qualities which formerly were thought of as a distinct feature either of the submarine or submersible, the time has arrived when all vessels that are capable of travelling beneath the water are classed generically as submarines.

In the article under discussion it is stated that the contemplated submersible battle cruiser would have little or no armor, "'because, while on the surface she would lie awash, or nearly so, and would not need it." How, by any stretch of the imagination, can cause and effect be so related? If we construct such a battle cruiser and equip her with heavy guns, we presumably except her to fight them, and our estimate must be very low indeed, both of the destructive effect of a heavy caliber shell on the unarmored deck of a submarine and of the fire control efficiency of any probable adversary, if we are to assume the untenable premise that a submarine cannot be hit and the equally fallacious corollary that if a hit is made, only minor damage will result therefrom. The life of a submarine is generally, and quite properly, reckoned as one hit from any caliber gun. The most enthusiastic advocate of the submarine will hardly deny that at least one good, solid, major caliber hit can be inflicted by

capital ships on a submarine at battle ranges; this, in spite of the inherent advantages possessed by the submarine in her low visibility and the small area of her exposed, above water surface. In other words, if we are to construct a submarine capable of joining in a gun duel with a capital ship, we cannot rightfully assume that the submarine will be impervious to shell fire. It may be difficult to hit her, but she *will* be hit and while one shot may not result in sinking; it is very probable that diving ability will either be seriously interfered with or entirely destroyed. Then she will be at the mercy of the enemy.

It must also be borne in mind that no matter what type of construction we apply to our submarine, she will always be more or less of a poor, low and wet, gun platform and will provide only limited fire control facilities; for once the compromise between surface craft and submarine is permitted to swing too far in favor of the many desirable surface qualities, the value of the submarine as such, is decreased in proportion as the surface efficiency is enhanced. We cannot have high surface and submerged efficiency in a submarine any more than we can have both the heaviest armor and armament in a dreadnought. The balance must be struck.

In one part of the article, speaking of the submarine battle cruiser, the statement is made that "it is easy to imagine such a vessel acting as a destroyer, making and repelling torpedo attacks and carrying out screening operation," and a few pages following, in speaking of the same type of ship, we read the remarkable and contradictory statement, "If it tried to operate on the surface as a destroyer, it would lack the destroyers' speed and flexibility. "Pursuing this course of reasoning and accepting the latter statement, it appears that a severe strain might be placed upon the imagination and the success of the venture even put in jeopardy, if we are to acknowledge, without comment, the truth of the first assertion. In our entire consideration of the submarine battle cruiser it is well to remember that while the theorists' conception of a submarine may be a vessel capable of almost instantaneous transition from surface to submerged and submerged to surface capabilities, in practice, it will be found that it is not the gay proceeding of diving and surfacing like a porpoise but, in fact, that each maneuver requires the expenditure of altogether too many precious moments to get the vessel under proper control for gun or torpedo fire. The same reasoning holds true here. We cannot have a submarine possessing the same surface qualities as a destroyer.

We are all prone to accept with great enthusiasm and almost unbounded faith the advent of a new device, which, it may seem, will aid us in accomplishing the end we have in view. Such is the case with the anti-submarine devices developed during the war. The very secrecy in which all development and research work has been veiled and the popular ignorance of the true limitations of these devices, have given to them a potential power of detection, transcending the most enthusiastic claims of their inventor. We have training wires and eels, SC, MB, MV, K and Y tubes and, I presume, many other contrivances whose avowed purpose

it is to seek out and destroy submarines and his name would be fool, who would deny the merits of these ingenious devices. But how, by any stretch of the imagination can we say, as do the authors, that the anti-submarine devices were fatal? To the reader who has had access to the records of anti-submarine experiments, it must appear so, but it will also be found that many of these experiments were carried out under perfect weather conditions, with certain elements of the artificial entering into the tests and that in a majority of the most successful tests, the listening was done by the inventor himself; a man whose broad knowledge of physics and accoustics and natural high proficiency in handling the invention of his own mind, puts him completely out of the class of ratings that we, in service, must depend upon. It will not be denied that anti-submarine devices helped materially in combating the submarine menace but it must be emphatically denied that they were fatal. They were a hinderance to submarine operations and a bothersome thorn in the sides of submarine commanding officers but, if we are to accept the statement that these devices sealed the fate of the submarine, so then, must we also accept every incorrect and unbased conclusion that flows from this source. If the fate of the submarine has already been sealed then why is every important naval power in the world continuing submarine construction? For our own protection, we cannot subscribe to such morbid delusions and transgressions of fact.

In the particular type of anti-submarine warfare in which the Allies were engaged against Germany, practically every condition of sea and land was favorable for this work. The German submarines were, for the most part, operating in restricted areas and comparatively shallow water. Both of these conditions made the anti-submarine devices more effective. It is hardly conceivable, and is not generally admitted, that submarines will ever again be employed under the same conditions and in the same rôle as were those of Germany. Hence, it will be found that our estimate of the capabilities of anti-submarine devices will have to be materially changed in drawing up plans for their use in possible future wars. Do we know, for instance, that their efficiency will be the same when operating in hundreds and thousands of fathoms of water as when employed in the comparatively shallow waters contiguous to the British Isles? Do we know that anti-submarine craft, equipped with all the most modern devices, can be employed to advantage against large fleet submarines in the open sea, when a large number of high powered ships, causing great sound interference, are present? Countless numbers of similar questions could be propounded and the answer to all of them, based not on theory, but upon lack of conviction in practice, would be the same. We not only do not know these things to be true but we have every reason to believe that these marvellous, delicate instruments will not obtain the results which their advocates claim for them. It may be well to state here that I speak not merely from the perusal of records but from experience both in the capacity of the pursuer and the pursued.

It is perhaps well that the technical discussion as to the inability of the submersible to dive and go to great depths was dispensed with, for it is believed that proof of these statements would involve a laborious and circuitous process of reasoning not founded on fact. While it may be conceded that large submarines will, perhaps, take a longer time to dive then small submarines, there seems to be no good reason why this time element should be of such duration as to endanger the safety of the submarine. If such a reason does exist, then why build submarines? Neither is there anything to prevent the construction of large submarines capable of going to the same depths that are required by the specifications of our present day submarines.

That part of the paper which has to do with the motive power of submarines is so misleading as to require almost complete refutation. The gasoline engines formerly used for submarine propulsion were, of course, not only dangerous because of the inflammability of the fuel but also, because many men were permanently poisoned by the noxious fumes of combustion. While it cannot be stated that the Diesel engine is a perfectly reliable machine, the cruising performed by German submarines during the war, and the every day runs that are now being made by Diesel engine merchant vessels all over the world, are in themselves sufficient evidence to confute the statement, made by the authors, that excessive weight and general unreliability accompany all internal combustion engines. If steam were used for surface propulsion there might be no necessity for other means of surface power but if there were, it is difficult to understand why, as they contend, a ship of the size under discussion could not be equipped with any other type of motive power, in addition to her steam installation. Indeed, the very increase in size is the reason why more machinery could and would be installed.

While it is true that the lead-acid type of storage battery does, under certain conditions, generate chlorine and hydrogen gas, in our service the casualties resulting from such generation of gas have been so few as to warrant the statement that their prevention and diffusion involve nothing more than ordinary, routine care. It is a sad fact, known by many in our service, that the alkaline battery, stated by the authors to have replaced the lead-acid battery, is capable of copious generation of hydrogen gas. The foregoing is one of the main reasons why, several years ago, after an unfortunate explosion of the experimental alkaline battery installed in the *E-2*, this type of cell was condemned for all future construction. There is not now one single alkaline storage battery, installed as the main battery of a submarine in our navy.

With regard to the use of the torpedo, it can hardly be conceded that a torpedo hit is purely a question of luck, as the authors state is to be. To be sure, an isolated long range shot, fired in the expectation that it will hit a certain definite target, is an absurdity. If, however, we are to have fleet submarines, we will have enough of them and they will each have a sufficient number of tubes to fire "Browning shots," with the practical

certainty that a percentage of torpedoes fired will cross the enemy line. Hits may or may not be made, but the enemy cannot but be greatly inconvenienced and hampered by such an attack. Jutland proves this.

This criticism has been written, not with the intention of discrediting views held by others, but rather, because of the general lack of knowledge on the part of the service at large concerning submarines, it is not deemed proper to allow to go unchallenged, statements which, owing to their wide variation from fact and practice, may only tend to more throughly confuse the submarine controversy. Such comments as have been made would be injurious rather than helpful, were not some consideration given to the ultimate development of the submarine.

There is, I believe, unanimity of opinion that submarines serving with fleets of capital ships must fulfil the following general requirements:

(a) Large cruising radius.
(b) Sufficient surface speed to accompany the fleet under all conditions.
(c) Good sea keeping qualities and habitability.
(d) Powerful torpedo armament of long range torpedoes.
(e) Good average diving and submerged qualities.

Some of the foregoing characteristics have already been attained and others are rapidly approaching a satisfactory solution. We know, from experience, that they are necessary; whereas the discussion of the submersible battle cruiser is still in the academic stage and all theories now held must travel the tortous road of satisfactory demonstration. With our general requirements before us, the sphere of the fleet submarine is not difficult to determine. The submarine force will be just as much a part of the fleet as the destroyer force is now. By reason of the fleet submarines' ability to accompany the fleet under all conditions, the commander-in-chief may find it expedient, and particularily to his advantage, to use the submarine force.

(a) To attain a favorable position before they submerge for torpedo attack.

(b) To gain and hold a position that will force the enemy to accept an inferior tactical position.

In both of these cases we have the *raison d'etre* of high surface speed. To obtain it, some other desirable quality, probably submerged speed, must be sacrificed and in order to deliver successful torpedo attacks against high speed surface craft, it is readily apparent that it will almost always be necessary to gain a fairly good surface position before submerging. It is noteworthy that the world wide tendency is to sacrifice submerged speed to surface speed.

Considering (b) above it is generally admitted, and has proven true in practice, that whereas surface craft that have the task set for them of turning an enemy column, may be driven off by a superior force, a group of submerged submarines is a real and a moral deterrent and may succeed when surface vessels fail.

After all, since the purpose of the battle is to destroy our adversary, it matters little as to what means and weapons are employed to effect this end. Even though the submarine force is unable to consummate a torpedo attack, the general plan is carried out, and if the enemy is forced to avoid the locality in which our submarines have been placed and thereby accept a tactically inferior gunnery position, the task of the submarines will have been well accomplished.

The Soul of the Service

(SEE PAGE 351, WHOLE NO. 217)

CAPTAIN W. T. CLUVERIUS, U. S. Navy.—1. The anomalous condition of a shortage of more than 50 per cent in total authorized commissioned strength combined with an actual excess in the complements of the three lower grades of the line is enough to try the "Soul of the Service."

2. Captain Jessop's article is timely for it is necessary indeed, in this serious post-war period, to determine first, what professional attributes are missing in the quickly-promoted junior officer and then, what modifications in training must be made in order to re-equip him as nearly as may be for his life's work. The writer inquires into these points well and finds that all the losses are based in that inclusive one of experience. With it was lost training in that subordination which comes with training at sea, close supervision by older officers and the benefits of that association, and the crystallizing of ideals of duty which, because they must be deep rooted, are of slow growth.

3. Much in these elements was lost to the junior officer of the line long before the World War—lost with the passed midshipman and the two years probationary period at sea where, under continuous control, the aspirant for a commission was trained in the duties of a subordinate and drilled in the acceptance of responsibility. He learned the details of his profession from his division officer, and, day by day, military character was formed.

4. Annapolis has realized and shouldered these losses, especially those entailed by the rapid promotion in war, and is trying to bridge the arc as best it may in a systematic manner.

5. The Naval Academy is often criticized for this or that lack in professional equipment discovered when the graduate joins a ship. Professional demands, both practical and theoretical, are greater than ever before and growing. It is simply impossible to cover the field in four years. Yet at all times there are attempts from without to shorten the course of instruction when the need is to lengthen it. There are those, too, who say let them get this or that aboard ship. Some of the essentials of our profession can never be absorbed after graduation. The abandonment of the two years' cruise was a lesson in this matter: the ensign of to-day lacks much professionally that the ensign of yesterday acquired as a passed midshipman.

6. I agree with Captain Jessop that academic methods suffer restriction and must of necessity at certain points be artificial. Nothing can make up for experience. A midshipman must stand on his own foundation and a gradation by marks is imposed. This is the only criterion of academic achievement, but I cannot agree that it is "as true of discipline as it is of any other study." Moreover, it is my observation that in all professional departments at Annapolis to-day the "question of the usefulness of what he is being taught" is so continuously brought to a midshipman's attention that to some degree "it must enter his head." Unfortunately in many respects, the proper striving for marks is not prevalent now because a "two-five" means a commission. Too often this mark can be made without sufficient effort and scholarship suffers.

7. There is no one discipline department as such. There is an Executive Department of which, in addition to his other duties, the Commandant of Midshipmen is the head. Under him is a commissioned officer attached to each company of the Regiment of Midshipmen whose duty it is to teach his men the executive requirements of their profession; to instill in them the instincts of duty; and to formulate their military character, all the while maintaining discipline and causing them to maintain it.

8. Annapolis is the school of the line of the navy. Midshipmen officers and petty officers are given standardized duties and comprehensive authority in the exercise of command which is the function of the line. They are guided, advised, and backed, by the commissioned company officer. With the midshipmen's responsibility based on regimental ranking and rating come their privileges: not with longevity, that is, not with class.

9. Similarly in the professional departments, the commissioned personnel are held accountable for the maintenance of discipline and the determination of military character displayed by the midshipmen when engaged in those departments. Just as the gunnery officer, the engineer officer, and the navigating officer are responsible in our ships, so are all officers attached to the Naval Academy. The Commandant of Midshipmen corresponds with the Executive Officer in coordinating the whole.

10. The matters of leadership and command are constantly dwelt on by the Executive Department and service interest is enhanced by a succession of addresses made not only by the most distinguished officers of our fleet and service, but also by foreign flag officers and general officers whose names are world wide and who are frequent visitors to Annapolis. Without exception they remark on the spirit they find and in their contacts with midshipmen, dwell on our glorious traditions which are an inspiration to further effort.

11. Yes, Annapolis is striving to the utmost to fill the gaps. But training in the full sense of duty when it comes and the assimilation of the spirit which Annapolis enjoins is a post-graduate course for the fleet, and the fleet must see to it that no "naval holiday" in these essentials is permitted. On the contrary it is the bounden duty of every officer in the fleet to show in himself that the newcomer's vision of service is unimpaired.

U. S. NAVAL INSTITUTE

SECRETARY'S NOTES

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Whole Nos. 6, 7, 10, 13, 14, 15, 17, 144, 146, 147 and 173 of the PROCEEDINGS are exhausted; there are so many calls for single copies of these numbers that the Institute offers to pay for copies thereof returned in good condition at the rate of 75 cents per copy.

ANNAPOLIS, MD., March, 1921.

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THE FATE OF THE DREADNOUGHT

By Lieut. Commander G. B. Vroom, U. S. Navy, and
William Oliver Stevens

CORRECTION

The statement that "the alkaline type of battery has supplanted the acid type" should read: "it has been attempted to supplant the acid type battery with an alkaline type, so far without success."

PROFESSIONAL NOTES

PREPARED BY

LIEUT. COMMANDER H. W. UNDERWOOD, U. S. Navy

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FRANCE

THE FRENCH MARINE MINISTRY.—There are signs that Mons. Guisthau, in contrast with his two predecessors, will be a man of action, and will have at heart to be something more than a "Ministre de Parade," and to leave, in a year or so, the Marine Francaise in a better condition than he finds it, being well aware that something more than eloquence is needed to mend matters at this stage. He wisely decided to get rid of the naval advisers responsible for the plight of the service. The situation is critical, and the gravest question of the moment is recruiting. The strength of navies lies not in numbers, not in outward force, but in the spirit, in the discipline and devotion to duty of officers and men, and it is a sad fact that the spirit of the fleet is being poisoned by anti-patriotic propaganda, and that state arsenals, Toulon especially, are hotbeds of anarchy. Stern repression and counter-propaganda are the urgent remedies.

Although the Chef d'Etat-Major Général de la Marine cannot be said to enjoy quite a great power and influence as those exercised by the British First Sea Lord, he is the most important man at Rue Royale, and the only official in a position to enforce some continuity of views and efforts, and to make up in some measure for the continuous change of improvised Ministres de la Marine. Hence the importance that attaches to the dismissal of Admiral Salaun, who came to power just over a year ago, and was the real Minister of Marine under the nominal responsibility of the honourable Mons. Landry, who received "le portefeuille de la Marine" by mere luck, and was totally unprepared for such vital functions. Whilst there have been no fewer than eight Ministers of Marine since 1914, the number is limited to five Chefs d'Etat-Major, viz., Aubert, de Yonquières, de Bon, Ronarch, and Salaun, and of these Ronarch appears to be the only one who had a constructional program of his own, and could have achieved something had his authority been greater. As to Admiral Salaun, he came to Rue Royale with a high reputation, and much was expected of him, but the sad fact is that he leaves the navy, in every way, in a poorer

condition than he found it; and this is the true criterion of worth. His narrow-minded cuirasséphobie is responsible for the loss of four 25,000-ton battleships that could have been completed by now. His dislike for size caused him in 1914 to reduce from 6000 to 4500 tons the 1914 type of éclaireur, and also to oppose the increase of the displacement of the 1919 croiseurs-légers, which ex-Minister Landry described as "petits mais extrêmement rapides et puissants." There might be plausible arguments for the systematic research of the smallest possible size in every class of warship, but there can be no excuse for the stagnation, waste, and anarchy that have marked the 1920 naval year. The lack of a firm will at the head has never been more patent to observers.

It looks as if the Grand Admiral Aube had left behind him only inferior disciples, respectful of the letter, but ignorant of the spirit of his teachings and without his wide intellectual horizon and managing ability. There was no fetishism about Aube. He was not bound to a narrow, absolute gospel, but above all a go-ahead and broad-minded naval chief, a believer in real work, and he proved it in setting arsenals and private yards in full swing, in ordering the first seagoing submersible, the first armoured cruiser (the 6300-ton Dupuy de Lôme, which was very large for her time), and the finest lot of light cruisers that the Gallic Navy ever possessed.

Whereas Admiral Salaun is a distinguished torpedo specialist and a worshipper of poussiere navale, his successor, Vice-Admiral Grasset, who is 57 years of age, is an eminent gunnery expert, who pins his faith in long-range firing and in heavy mastodons large enough to carry the offensive and defensive qualities required to meet the novel conditions of warfare. In the several scholarly volumes he published before the war he accurately guessed what would be the evolution of the naval art, and many consider him as being the most sagacious and broadminded French student of sea warfare. He is highly respected in and out of the service, and will enjoy the authority necessary for the successful discharge of his responsible duties. Admiral Grasset commanded in turn (as a captain) the cadetship Jeanne d'Arc and the Brest Ecole Navale. He had a comprehensive war experience at the head of the Atlantic Cruiser Squadron, and as Attaché in London. As Prefet-Maritime in Cherbourg, he turned into a position of active duties and go-ahead work, a post that is usually considered as a well-paid sinecure. He enforced discipline in the arsenal, and even bona-fide work, and organized naval sports on a large scale, one of his pet ideas being the continuation on the sporting fields of the Franco-British fraternity of arms. He thus appears to be excellently qualified to try and bring anew the Marine Francaise to life.

Minister Guisthau has selected to be Chef de Cabinet Capt. Durand-Weil (44 years of age), who, though being one of the youngest officers of his rank in the service, had been placed in command of the fleet flagship *Provence*. This brilliant and scholarly officer, who has the distinction of being the youngest Chef de Cabinet on Marine records, possesses considerable personal experience in Admiralty work in war time, and may be trusted to set the cumbrous Rue Royale administrative machine working at a more efficient pace. In naval doctrine he is no bigoted sectarian, but an open-minded champion of efficiency in all classes of vessels, and ready to welcome all sound weapons likely to add to the power and security of his country, battleships included. Like Admiral Grasset, he counts many English friends.

Mons. Guisthau's projects of undeferred work will be greatly facilitated by the widespread feeling among the public that glaring incompetence and apathy at the head have "saboté" France's naval weapons ever since the armistice. Verbiage, anarchy, and powerlessness in the Conseil Superieur, squabbles in the Parliamentary Commissions de la Marine, grand paper programmes changed every few months, but no new construction, no bona-fide war training, sum up the activity within the last two years of the ex-grande Marine Française, and waste and decline are the only apparent

return the Republic has got for the expenditure of over two milliards francs (1919-20 Budgets). No wonder France at large is utterly sick of words and paper achievements and demands "men of realization" and immediate action.

The Ligue Maritime, that counts 175,000 members, has addressed to President Millerand a petition in favor of the completion of the 25,300-ton *Normandie, Gascogne,* and *Flandre* that are afloat, with from 12,000 to 14,000 tons of materials worked into them, and could be made ready within fifteen months. The *Languedoc,* launched in 1915 at Bordeaux and not quite so advanced, is likely to be converted to auxiliary uses. The enormous cost of completing these ships, with a few modifications in the original design, will probably cause only two to be taken in hand, namely, the *Gascogne* (fitted as flagship) and the *Normandie.* These two ships, now at Lorient, would be completed side by side in that arsenal, that would be temporarily retained as a port militaire. Time and money would be saved by this concentration of battleship work in one yard. It will be agreed that two quadruple-turret battleships (12 guns of 13.4 with splendid shells, 24 guns of 5.5-inch, thick and extensive armor, 22.5 knots expected speed, without mentioning a substantial anti-submarine defense)—equal or superior in gun power to any British capital ship in commission, and far superior to the poorly-protected Dorias of Italy—would be worth more to French sea power than the construction of six inferior croiseurs-légers of 5000 tons, all the more so as the five recuperated Boche scouts, due to become available this year, will to a great extent fill the gap for which the cruiser programme was intended. With nine modernized dreadnoughts in the Mediterranean in 1922-3 (mounting 54 guns of 13.4 and 48 of 12-inch), supported by up-to-date aerial and submarine flotillas, France will regain prestige and security and avoid unpleasant incidents. For, as said the grand old man of France, Clemenceau: "Lo grande guerre n'a pas changé la nature humaine; la force reste la seule sauvegarde de paix pour tourte nation pacifique."

Professor Flamm's wonderful submarine invention is a further sign that united and thriving Bocheland intends yet making her future on the sea, and renounces none of her former ambitions, but on the technical issue Constructor Laubeuf, the greatest living authority on submarines, has shown the candid Boche assertions to be totally unfounded. "Anybody can design 10,000-ton submarines. I could, if desired, design to-morrow 25,000-ton submersibles, but reliable successful construction is the difficult thing; and then there is the question of cost and military utilization. In the matter of armament, the Boches have found nothing that was not already existing or experimented upon, either in France or in England." For the price of a 10,000-ton submersible it will always be possible to get better value in fast surface ships, or in smaller underwater craft.

Much sympathy is expressed with the British Navy on the loss of the fine submarine, *K-5.* The type is considered as representing a fine constructional achievement, being in the motor part an enlarged copy of the geared turbine French submersibles of the 1912-13 designs. The delays, difficulties, and dangers in diving experienced during the war with the many French steam submersibles have caused the rejection of that type as being "unmilitary." The fate of the *K-5* is an argument against size in submarines and in favor of surface ships.—*The Naval and Military Record,* Feb. 9, 1921.

GERMANY

INDUSTRIAL AND ECONOMIC SITUATION IN GERMANY.—In view of the question of reparation having been brought to the front so prominently in the past few days, two publications which we have received are full of interest. The first is a small book in the French language by Mr. Raphael-Georges Lévy, member of the French Senate and of the Institut de France, entitled

"La Juste Paix," giving "the truth concerning the Treaty of Versailles," and forming mainly a courteous refutation of a book by Mr. John Maynard Keynes. We must confess that we have not read the latter, but the case made out by the French senator is undoubtedly a most able and most complete one. The second communication to which we allude forms a welcome supplement to the first, and is entitled "General Report on the Industrial and Economic Situation in Germany, in December, 1920," by Mr. J. W. F. Thelwall, commercial secretary to H. M. Embassy, Berlin, and Mr. C. J. Kavanagh, British Commercial Secretary, Cologne, issued by the Department of Overseas Trade. Both these communications come at a very appropriate time, in view of the recent inter-allied conferences in Paris, and the meetings last week in London of the Miners' International Federation, to enlighten the general public on the question of Germany's guilt, and on the real value of her assertions as to her incapacity—or, we may say, her capacity for repairing the damage of her own creation—and also on the real state of affairs in that country.

Coal shortage has formed a subject for complaint on the part of Germany for many months past, and the plea still continues to be put forward with great insistence. We have never believed that she has ever had an insufficiency of coal for her works, and the figures given and the statements made in the British report confirm our views in this respect. This report says that a certain proportion of the difficulties encountered in this connection arise from bad distribution, failure of transport, bad commercial markets at home and abroad, lack of orders, seasonal depression, deficiency of raw materials, etc.; a part of these difficulties it is in the power of Germany to remedy without outside aid. That she can do so is clearly indicated by the report, which states that, compared with 1919, railway traffic conditions are much improved, adding "the achievement of German industry and of the government departments concerned is very fine, and shows how great the productive power of the former is if it chooses to make an effort." Among the illustrations given to prove this is one to the effect that the coal situation for the "refining" industry has been considerably eased by the turning over to the utilization of brown coal briquettes, and the building during the war of large power stations at brown coal quarries, thus having provided industry with an economical source of electricity.

Further, it is stated, much attention has been devoted by the rolling mills to the utilization of brown coal, and considerable activity has been displayed in modifying plants to burn this fuel, the production of which in the Cologne Basin has been considerably increased. But our readers are not to infer from these statements concerning brown coal and its utilization that there is a lack of black coal in Germany, for such is not at all the case; they simply show that Germany is putting her industrial house in order on economical lines. Germany is still rich in both black and brown coal, as can be gathered from the figures of output for 1913 compared with those of the present day, and is quite able to supply the "reparation coal" demanded by the Treaty of Versailles. In this connection the number of miners employed is also instructive. According to the British report, the average number of miners at work in Germany during 1913 was 601,700, including 390,600 in the Ruhr district, whereas the total for December, 1919, was 724,597, excluding the Saar, but including 471,359 in the Ruhr district. It is not out of place here to note that the German coal exports amounted in 1913 to 34,573,500 tons, or 3,428,400 tons above the total for 1912. Germany's average annual increase in coal exports was over 2,425,000 tons for the six years from 1907 to 1913. On the basis of these figures her present coal exports, had there been no war, would be over 50,000,000 tons per year, or over 4,000,000 tons per month. Her exports for August last were 2,422,979 tons and for September 2,423,266 tons, consisting mostly of coal to the Allies. That the situation for her is not more satisfactory—

she would evidently prefer exporting coal in the usual commercial way to supplying "reparation coal"—is no fault of any of the Allies.

The question of iron ore supplies is again a vexed question which Germany will probably continue to put forward for many months to come, but she does not lack home iron ore to the extent she pleads, as we pointed out briefly in the course of a former article. At the present time, says the British report, ores are arriving in such quantities as blast furnaces can deal with on their present allotment of coke, but, it adds, steel production is considerably ahead of pig-iron output, partly due to imports of foreign pig, but chiefly owing to the utilization on a large scale of scrap iron. Pig-iron is not made simply for the pleasure of making pig-iron, but for converting it into steel; as Germany obtains her steel chiefly from scrap, and as she has seen to it that she has scrap to last her over a good while, she is not so badly off after all from the metallurgical point of view. At all events, she is not in a worse situation than we are in this country from the iron ore standpoint, as is shown by the following extract from the review by Messrs. William Jacks & Co., on "The Iron and Steel Trades in 1920," which says: "The broad fact remains that the Cleveland district has seen its best days as a mining district. Steel makers have solved the problem of producing high-class steel from basic iron manufactured from Cleveland ironstone only to find that the output of the ore is on the wane." And, we may add, Cleveland steel makers have probably much less scrap to work up than have the German steel makers. Condolence with Germany's situation in this respect is, therefore, somewhat out of place.

Moreover, still according to the British report, the German rolling mills in general are well occupied and, though suffering from a shortage of fuel and raw materials, a fair export turnover has resulted. The tin-plate industry is well supplied with orders. Structural engineers continue to be well employed and are reported to have orders in hand for foreign account; the coal strike in England resulted in orders being placed in Germany, and manufacturers were found willing to make fixed quotations and favorable deliveries. Manufacturers in Germany find little difficulty in working to British standard specifications, although the less stringent specifications of the Prussian railways, which, previously, did much to help the industry, work in their favor when accepted by foreign clients. The prejudice against basic material that was prominent in England, but nonexistent in Germany, was not only injurious to the British manufacturer quoting in foreign markets, but of assistance to the German. Another interesting statement which points to the excellent situation of the German metallurgical industry is to the effect that blast furnace and steel works appear to have continued without the large new issues of capital which have been so prominent a feature of the "refining" and engineering trades, "and the explanation is partly to be sought," the report adds, "in the ready market they found for their produce as well as in the good profits obtaining from export." All these remarks are liable to cause foreign ironmasters to view the German metallurgical situation with a certain amount of envy.

And the German engineering industry would appear to be in a better situation still, for we read in the British report that engineering and allied trades show considerable improvement in regard to the supply of raw materials, "cast-iron and steel being more plentiful on the market owing to an improved home production, imports, and also to a slump in demand." Further, manufacturers of specialized plant have been busy on foreign account. The coal strike, and high prices in England and the inability of British manufacturers to quote fixed prices and deliveries have resulted in orders being placed in Germany for locomotives, oil mills, rolling mills and electrical plant. A perusal of company reports shows that good dividends are being paid. The German market is very receptive for foreign orders, and every effort is made to meet the requirements of customers.

Nor does Germany's activity in iron and steel production and in every branch of engineering preclude her from carrying out research work, for she is said to have recently brought out a new alloy styled "electron," suitable for light castings; it is said to have a tensile strength of 12 kg. to 15 kg. per square millimeter (7.6 tons to 9.5 tons per square inch), with an elongation of 3 to 4 per cent. Among the non-ferrous metals, copper, lead, nickel and tin markets are said to have re-established themselves as nearly as possible on previous lines, while zinc interests are expectant in regard to future developments in Australian supplies.

Germany, as stated above, is admirably situated for the economic generation of electric current owing to the large resources of brown coal. She utilizes the brown coal on the spot for the generation of current and her overland power transmission schemes went hand in hand with the development of her war industries. These favorable conditions will play an important part in the further economic development of the country. In point of fact, it may be said that, in combination with her activity and also with the concentrated effort which proceeds from the pooling of interests and of experience on the part of manufacturers German trade is again rapidly coming to the front, and the term "German trade" includes not only the industries briefly referred to above, but also the dye and other chemical and various industries at which Germany appears now to be working with extraordinary energy.

As stated in the commencement of this article, the Miners' International Federation met in London last week. Among the foreign delegates present were Messrs. Hussemann and Hue, for Germany. The official statement issued after the last meeting pointed to the fact that stocks of coal to the extent of 900,000 tons in the Ruhr and 300,000 tons in Upper Silesia, had now accumulated, and added that transport facilities should be improved and overtime in the mines suppressed, etc. The preceding meeting unanimously resolved that "the socialisation of the mining industry in every country was of supreme importance," and "it called upon the workers to redouble their activities in favor of the exploitation of mines by the community." The figures above given by the German labor delegates point to the abundance of coal in Germany; in regard to transport, conditions are better now than they were and are sure to improve still if Germany only wills it. In the matter of socialisation, the British report says: "If any proposal is placed before the German working man which will safeguard him and his family from the worst effects of unemployment and will insure for him a modicum of comfort, he is likely to accept it, and not to bother much about saddling himself with responsibilities of administration. He has had time to learn since the revolution that it is possible to possess authority and yet be very badly off; now he will probably be more eager to obtain rather the substance of a steady employment and wages than the shadow of a position which he is unable to fill. As long as the considerable privileges which labor has already acquired for itself are confirmed, it seems probable that it will arrive at a compromise with the employers on the question of socialisation, and that the latter may be settled without the political and industrial disturbances which were at first anticipated. As far as German labor is concerned, therefore, British labor would seem to be "preaching in the desert." German labor has benefited directly and indirectly by our coal strike, and would most probably view further strikes in this country with the greatest satisfaction.

With regard more particularly to the book by Mr. Lévy, and very briefly, the French writer says that Mr. Keynes appears to object mostly to the clauses of the Treaty of Versailles "which transfer intolerable financial burdens from the shoulders of the victors to those of the vanquished." Mr. Lévy fails to see why the latter should have better treatment than the former; he, further, refutes Mr. Keynes' low evaluation of the damage caused by Germany in Northern France. He also points out how, shortly

before the war, German statesmen, bankers and economists extolled the richness of their country and its marvellous development, how the German works were second only to those of the United States, etc. He gives an abstract of the *étude* published in 1913 by Dr. Helfferich—former director of the Deutsche Bank, also former Minister of the Interior and Minister of Finances, in which this German expert dealt in detail with the great wealth of Germany as a whole. Mr. Lévy also states that the German iron and steel works were running at the date on which he wrote his book—a few months ago—at almost the two-thirds of their former capacity, while the French were running at only a quarter of theirs, and he has the impression that the German people as a whole are conspiring to maintain silence in regard to their output in order to move foreign nations to pity. That is also most decidedly our own conviction. Further, how there can be found men to assert that Germany should be treated kindly at the expense of the Allies passes conception.—*Engineering*, Feb. 4, 1921.

THE GERMAN 380-MM. 45 CAL. NAVAL RAILWAY GUN.—*General Features.*—The 380-mm. naval gun recoils in a cradle which is mounted on a girder-carriage of heavy plating and angle irons, reinforced and braced, the whole resting on two platforms of which the forward one rests in turn on two trucks of five axles each and the rear one on two trucks of four axles each.

PRINCIPAL CHARACTERISTICS

Total length of the tube	17.1 m. or 45 cals.
Length of rifling	14.0 m. or 37 cals.
Length of powder chamber	2.12 m.
Total weight on rails including trucks	270,000 kgs.
Distance between pivot centers of rear trucks	5.35 m.
Distance between pivot centers of forward trucks	6.70 m.
Distance between platform pivot centers	21.15 m.
Wheel-base (extreme front and rear axles)	31.618 m.
Mean load per axle	15 tons (1 ton = 1000 kgs.)
Mean length of recoil	1250 mm.
Horizontal angle of fire on trucks	2°
Maximum angle of elevation on trucks	17°
Maximum angle of elevation on platform	55°
Type of gun	Max. No. 52.

The Gun.—The gun (No. 33) is of steel, made by Krupp's in 1916, weighs 77,522 kgs., and consists of a tube, jacket, and hoops. The forward hoop is out of place on the tube by 10 mm.; the breech hoop has two splays or lugs to which are affixed the recoil piston rods. A yoke joins these rods to the counter recoil piston rod which is between them, the machined upper surfaces of the flanges of the counter recoil cylinder casing forming the bearing surface on which the gun slides into the cradle. The breech closing wedge has rapid translatory motion by virtue of a long pitched roller screw, and opens to the left. The block has a bracket for the electrical firing device (which bears the inscription: 2.5 amps, 16 ohms, 1200 coil turns). The block (or wedge) weighs 2580 kgs., has a forked ejector and consists of two parts, one of which has a safety lug preventing closure of the breech before the gun is properly loaded. The powder chamber, having a length of 425 mm., is joined to the bore by a centering slope at whose forward end the rifling commences. The lands number 100 and are of progressive pitch. The rifling is to the right. At the beginning (forcing cone end) of the rifling there is marked erosion of about 1.1 m. in length. In travel, the tube is held in the cradle by two heavy couplings.

Cradle.—The gun recoils in a cradle of cast steel which has a trunnion on either side resting in trunnion beds on the girders. At the rear end can be seen the pneumatic counter recoil cylinder betwen the two recoil cylinders.

Elevation is effected by means of four hand crank levers, two on either side of the carriage. These crank levers actuate two transversal shafts which are linked by sprocket chain to each other. On the right side of the cradle an arc graduated from 0° to 55° is affixed. The graduations are subdivided into mils. (1° = 16 mils.).

Trunnions.—Two strong trunnions are supported in cast steel trunnion beds or collars and appear during laying of the piece to rest on two small axles forming a roller bearing.

By appropriate means these rollers bear on a solid casting having uniform power of resistance, and they receive the weight of the gun from cast steel collars affixed to the trunnions by heavy set screws. These collars are flanged outwardly thus concealing part of the perimeters of the rollers. The latter (the rollers) have a diameter of 35 mm. At the instant of firing a lever or beam controlling the uniform bearing on the rollers and having a screw adjustment, probably yields sufficiently to permit the trunnions to bear directly on the trunnion beds. Dismounting the piece not being permitted, it is not possible to give a more definite description of the trunnions.

Recoil and Counter Recoil Mechanism.—The recoil cylinders contain perglycerine and the counter recoil is pneumatic. Diameter of recoil piston rods is 160 mm. Diameter of counter recoil piston rod is 500 mm. A gauge located toward the rear and on top of the cradle gives the reading of the interior pressure of the cylinders. (Hydraulic manometer, graduated from 0 to 250 atmospheres.)

On the rear head of the counter recoil cylinder there are a charging and a discharging valve, above, there is a safety blow-off, and below, an ajutage bearing the number 45. An inscription (metal plate) shows the capacity (Full: 132 liters), and the mean recoil as 1.25 m.

The Girder Carriage.—The carriage consists of two girders made of heavy plating, angle irons, and bracing, bolted and joined together by transoms. On the upper surfaces are fastened cast steel trunnion beds. To the rear of the trunnion bed on the left hand girder the panoramic sight bracket is fastened, also a hand pump, a case for the sights, and a winch for hoisting projectiles in firing from a platform. A level-arm slide giving the angle of sight by means of the half circle fixed to the cradle, a sight case, and a winch serving the same purpose as the other, are all located on the right girder. The carriage is prolonged to the rear by an iron foot bridge, the two being made rigid by two strong supports and two cables tightened by turnbuckles. A supporting bracket having a roller bearing and moving on a suitable roller path on the rear truck upholds the overhang of the foot bridge. The shot truck travels on rails along the foot bridge.

An arched beam bolted to either side of the carriage probably serves to effect the transfer of the projectile from the feeder shot truck to the loading truck, the block and fall suspended from the arch being operated by means of the two winches mentioned above.

The carriage is supported fore and aft by two heavy platforms which in turn are supported respectively by the two forward trucks and two rear trucks. The forward end of the carriage has limited lateral motion across the forward platform so as to permit of laying the piece in direction in firing from the trucks. The maximum motion is 1 degree to either side of the longitudinal axis of the carriage, a graduated arc and index enabling off-sets to read to mils. This motion may be made in either of two speeds (low and high) by two cranks and a set of gears fixed to the forward platform. The cranks turn a screw which engages in a rack attached to the carriage. Two inaccessible fly wheels located between the

two forward trucks appear to damp any movement of the carriage on the forward platform.

Trucks.—The two forward trucks have five axles each. Extreme wheel base (of one truck) 5.12 m. Three of the axles are braked: the middle and the two outer ones.

The weight supporting springs, except for the middle axle, are joined by an equalizing beam. Before firing, screw bolts which are raised in travel are screwed down thus taking the weight off the springs, the shock of discharge, therefore being borne directly by the axle boxes. On the right of the axle boxes of the middle axle the screw bolts are replaced by a buffer box.

The wheels of the first forward truck have a diameter of 950 mm. Those of the second forward truck have a diameter of 940 mm. These two trucks resemble those of the 280 mm. German Railway Gun. The distance from pintle center to pintle center of the forward trucks is 6.70 m., and of the rear trucks is 5.35 m.

The two rear trucks have four axles each. Maximum wheel base is 3.75 m. All axles are fitted with supporting springs and all have the shock transmitting screw bolts. These trucks resemble those of the 240 mm. German Railway Gun.

Mean weight per axle in travel is 15 tons (approx.).

Mean weight per axle in firing is 30 tons.

Minimum radius of curvature for travel is 100 m.

Minimum radius of curved epi for firing is 180 m.

This matériel is of international standard gauge.

—*Journal of the U. S. Artillery*, Feb., 1921.

GREAT BRITAIN

THE NAVY IN THE PACIFIC.—There appear to be no grounds for attributing particular significance to the meeting which is about to take place at Singapore between the commanders-in-chief on the Australia, China, and East Indies stations. Meetings of this kind took place on several occasions during the pre-war period, in accordance with the rule laid down by Lord Fisher soon after he became First Sea Lord in 1904. He chose Singapore as a convenient rendezvous for the China, Australia, and East Indies squadrons and as a base for their use when they combined to carry out joint exercises as the Eastern fleet. The first reports of the forthcoming meeting indicated that the senior officers of the South African, Canadian, and New Zealand commands would also be present, but this turns out to be incorrect. The Singapore conference must therefore be considered simply as a revival of the former practice which naturally fell into abeyance during the war. The value of such conferences is self-evident. They afford the commanders of oversea squadrons an opportunity of foregathering at intervals to exchange ideas and discuss topics of common interest, among which the strategical problems likely to arise in certain eventualities are not the least important. There is no doubt that, were a crisis to occur in the East or the Far East, the Royal Australian Navy, the China Squadron, and the East Indies Squadron would coalesce into one fleet under a single command, and it is therefore essential that the closest possible touch be at all times maintained between these units. From the circumstances that the *Brisbane* is to be the only R. A. N. ship present it is evident that on this occasion no joint maneuvers or exercises are contemplated. But the fact that such a meeting is to take place at all shows that British naval policy, no longer fettered by commitments in the home seas, is in process of readjustment to conform with the new requirements of the world-wide strategical situation.

Although the Imperial naval forces that are immediately available in the Pacific are small by comparison with the other fleets stationed in that

area, they are by no means negligible, and once united they should be capable of holding their own until the arrival of reinforcements. The Royal Australian Navy was partially demobilized last autumn, but the ships that were paid off are kept in good condition, and, according to official statements, could be manned and made ready for active service at short notice. Leaving out obsolete ships and auxiliaries, the Australian fleet unit comprises one battle-cruiser, four fast light cruisers, 12 destroyers, and six ocean-going submarines. While the battle-cruiser is not of the latest design, her relative value would be high in the Pacific, where at present the number of ships of this type is strictly limited. On the China Station we have five fast light cruisers and 12 of the latest submarines, and in the East Indies there are two light cruisers—excluding the *Highflyer*, which is quite obsolete and ought never to have been recommissioned. In case of need, therefore, we could assemble in the Pacific an Imperial squadron consisting of a battle-cruiser, 11 light cruisers, and 18 submarines—a force which no prospective enemy could afford to ignore. Canada is not yet in a position to make any substantial contribution to the Eastern fleet, nor is she well situated geographically to take part in naval operations in the western Pacific. She is, nevertheless, vitally interested in the maintenance of the balance of power in that ocean, and there is no doubt that her future naval policy will be guided mainly by this consideration.

It is impossible to dissociate either American or Japanese naval expansion from the strategical problems of the future. Not that there is any serious prospect of our coming to blows with one or other of these nations, but simply because they happen to be the leading Powers in an ocean where British interests are very great. The United States, which recently deemed it expedient to transfer half her battle fleet from the Atlantic to the Pacific, would not be likely to complain if it were decided gradually to build up a powerful British fleet with its cruising ground in or adjacent to Australian waters, nor would Japan misconstrue the taking of any reasonable precautions to safeguard our interests oversea. As regards the United States, it is to be hoped that people in that country have taken due note of the very important statement made in the *Japanese Diet* last week. On being asked whether Great Britain considered herself exempt from the obligation to assist Japan in the event of a war with America, Count Uchida, the Foreign Minister, replied that the United States was never regarded as a country to which the Anglo-Japanese Alliance applied. Japan, he added, did not interpret the alliance to include England in a Japanese-American conflict. This declaration, superfluous as it may seem from our point of view, should do something to remove the chief obstacle which stands in the way of an Anglo-American naval understanding, for *The Times* correspondent in Washington assures us that "it is Britain's relationship to Japan which in the last resort will determine American policy as to relative naval strength" with this country. Failing an agreement with America it is difficult to see how we are to avoid the alternative of reinforcing the fleet in the East and elsewhere on a scale commensurate with our vast maritime interests.—*The Naval and Military Record*, Feb. 16, 1921.

"THE FUTURE OF THE BATTLE FLEET."—*Foreword.*—These speculations are conceived from the point of view of the British Commonwealth; such procedure is perhaps less impressive than would have been treatment of the subject from an abstract standpoint, but it seems to have the merit of being more practical.

War is such a very practical business that in writing about it we should be practical, that is to say, simple.

For example, except after a full stop, war should not be written with a capital "W," nor should it be hinted that there is a dark, profound mystery in the business, which can be illuminated and plumbed by catch phrases and sentences torn from Clausewitz's context, or other standard works.

To write in this manner is to suggest that there is a War Students' Trades Union, whose secrets will sometimes be partially revealed to the outsider.

War only differs from other enterprises undertaken by man in that the issues at stake are more tremendous and dramatic than those depending on the outcome of most transactions of peace.

Part I.—In April, 1917, the British Empire was perilously close to defeat owing to the sinking of world tonnage by the German U-boats. In this fact lies the greatest of the many lessons to be learnt from the last war.

It will be suggested in these pages that if we mean to profit by this lesson, we must revise our present attitude towards naval warfare and adopt what will seem to be a new attitude, but is in reality very old; we must rid ourselves of many comfortable theories and look into some uncomfortable facts; we must be prepared to find that our ideas as to the composition of a fleet are in error, and that we have spent millions of pounds on a tool which is only capable of doing half the work which may be necessary in war.

These statements, if correct, are disturbing; but in a business, if a mistake is made it often pays to cut losses without waste of time.

Preparation for war and war is a business.

During the past centuries English opinion has almost continuously believed in the doctrine that the immediate purpose of the fleet is to destroy the enemy's armed ships.[1]

There has been, and may be still, a school of thought who argue that the navy can efficiently fulfil its task without destroying the enemy fleet in battle, but this opinion has not been that of the majority.

It will seem strange to a historian a hundred years hence, that though the evidence shows that the British fleet from 1600-1920 was brought up on the theory that its main business was to destroy the enemy in battle, yet for months on end between 1803-1805 and 1914-1918 (to mention only two periods) the fleet could not translate its theory into practice. Our imaginary historian (probably a learned civilian) may write rather pompously:

"From the middle ages until the close of the Great War practice gradually became divorced from theory. At the conclusion of the Great War a deep impression was created as a result of the nearness to defeat in 1917 of the old British Empire. It was realized that practice must be re-introduced to theory before the next war, and close attention was paid to the scanty records of naval warfare in the pre-Christian era and all examples of later date in which, as at Copenhagen, a fleet destroyed its opponent notwithstanding all obstacles."

* * * * *

It is important to establish why the navy was not able to put its theory into practice for long periods during 1803-5 and 1914-18.

The answer is simple. The enemy fleet sat in the fortified harbors of Brest and the Elbe River.

Were these sufficient reasons to prevent us attacking them?

According to our theory they were not, but in practice they were. The truth was that the British fleet was *not designed* to destroy the enemy fleet in battle, either in 1803 or in 1914. It was designed to destroy the enemy fleet in battle *at sea*. It was a one-handed fleet, instead of being ambidextrous. This is no new discovery. Our great-grandfathers, leading a life during Cornwallis' blockade off Brest compared to which Scapa Flow was a bed of roses, longed to get at the French fleet.

[1] The writer's belief in this well-flogged question is as follows: "Object of the navy to control sea communications, therefore it follows that the immediate ideal should be destruction of enemy forces, for when they are utterly destroyed, most of our fleet can go on leave; the control of sea communications being carried out by Ministry of Shipping and Foreign Office."

We find Captain Puget (the original author I suspect to have been that dare-devil, Lieut. Ussher), writing to Cornwallis on June 23, 1804, and enclosing his plan for attacking the French fleet in Brest. Cornwallie passes it on privately to Lord Melville, who on July 10 replies:

"The national advantages attending its success are too obvious to require illustration."

Cornwallis to Melville on September 11 writes:

"It is a daring service, but I have always been of the opinion that much might be done by surprise, and I have formerly thought that our ships, though superior to all the world at sea, were not always so secure at anchor."

For reasons which are not all very clear, except that amongst other causes was the fact that the naval members of the board threw cold water on the enterprise, the project was abandoned on the eve of execution.

One can imagine Captain Puget, sick at heart with the prospect of another winter's work off Brest, when he wrote to Cornwallis on September 23, 1804:

"Sir—The presentation of plans to you lately for harassing the enemy have been so frequent that I have been deterred submitting the enclosed. . . . ."

There is an echo of what must at this time have largely occupied the minds of the officers in Cornwallis' fleet, in a letter from the Mediterranean, written on December 30, 1804. Nelson writing to Cornwallis, said:

"We could always beat a Frenchman if we fought him long enough: that the difficulty of getting at them was oftentimes more people's own fancy than from the difficulty of the undertaking: that people did not know what they could do till they tried, and that it was always to err on the right side to fight."

Before passing to 1914-18 it is of interest to note that it was fully recognized in 1804 that the seagoing fleet was unsuited for this task of harbor battle.

Almost apologetically does Captain Puget ask for special material; he emphasizes the small quantity he will require, but he states plainly to Cornwallis in his opening letter of June 23:

"As the success of this enterprise must principally depend on equipment and fitting these vessels (special fire-brigs) . . . ."

There is also mention in a letter to Cornwallis from Admiral Young at Plymouth, of special grapnels, the parts of which were made by different men in order to ensure secrecy.

More than a hundred years later we come across certain young officers putting forward startling schemes to attack the High Seas fleet in Schillig Roads with fast motor boats and torpedoes.

The main idea of the scheme never materializes, but the idea of the motor boat becomes the C. M. B. and does useful work in 1918 at the small harbor battles of Zeebrugge and Ostend.

From these episodes, a hundred years apart, two conclusions can be drawn.

In the first instance it seems as if in each great war there was an underlying feeling that somehow or other it was wrong just to sit and wait for the enemy to come to sea. If he would not come out, then we must go in; that summed up the matter. But in each instance one has the impression that these disciples of the harbor-attack doctrine did not carry enough weight to impress their ideas on the men who directed British naval strategy. Perhaps they would have been better at forcing their way into Brest or into Schillig Roads than they were at stating their arguments. Why the attacks did not materialize is of secondary importance; it is sufficient for our present purpose to note that this feeling something should be done to get at the enemy fleet has been latent in the navy.

The second conclusion which can be drawn is that special material is required.

In 1804 it was a special type of fire-brig, with grapnels (specially made), etc.

In 1914-15 it was a special form of motor boat with special arrangements for carrying and discharging a torpedo.

Nowhere do we find a hint that the main battle fleet itself could do anything save wait in a hopeful attitude.

At the risk of becoming monotonous I want to repeat again that the battle fleets of 18th, 19th and 20th centuries were designed and trained "To seek out and destroy the enemy; but *only when he was at sea.*" A man of genius rose superior to this limitation at Copenhagen and to a lesser degree at the Nile, but no genius could have taken the Grand Fleet into Wilhelmshafen in the last war and returned.

* * *

I propose leaving the first thread of my argument at the point it has reached in the preceding paragraph and picking up the second at its beginning.

Lord Melville said of the first Brest proposal:

"The national advantages attending its success are too obvious to require illustration."

Let us speculate.

In 1804 England was experiencing the sensation that she was face to face with a great crisis in her history; we know the feeling, we had it in March and April, 1918. I feel pretty certain the government had it in April, 1917,[1] though the censorship veiled it from the people on that occasion.

In the autumn of 1804, Napoleon's great invasion plan seemed nearly ripe to bursting point. Nelson, Cochrane, Cornwallis, and Lord Keith kept anxious watch from Toulon to Boulogne.

If the October 8 coaches had carried the news through England that on October 1 the gallant Osborne and Puget with 153 men had destroyed the French fleet in Brest (and it must be remembered that the men on the spot from Cornwallis downward believed it could be done), the country would have breathed one huge sigh of relief.

Napoleon's letter to Decrès in such circumstances would have been worth reading!

Yes, it would have been a notable day and perhaps changed the history of the world and saved Nelson's life; but by no stretch of imagination can we say that upon it depended, or even seemed to depend, the fate of England.

Change the scenery and raise the curtain at No. 10, Downing Street. Time: April-May-June, 1917. But first a few stage directions. England, the keystone of the Imperial arch, is, with the possible exception of Japan, the only country in the world which depends for the continued existence of its inhabitants upon food brought across seas.

The empire is at war, these islands have become its chief arsenal, and the raw material which modern war consumes so greedily, must also come across the seas.

Tonnage is being sunk by U-boats at a greater rate than it is being replaced.

Expert jugglers with figures have proved that if the rate of decrease is not diminished, the minimum figure will be reached on September 1, 1917. They have neglected the morale factor; so let us suppose October 1 to be the ultimate date upon which we shall be faced with the problem of making 2 plus 1 equal 4. Dramatis Personæ: The Cabinet; The Admiralty.

The Cabinet.—Here is the situation: The fate of the empire depends upon your success in reducing the rate of sinking. What can you do?

The Admiralty.—The solution lies in sinking more U-boats. There are two alternative methods of achieving this:

[1] "The Victory at Sea," Chap. I, by Admiral Sims.

(1) The rate of U-boat destruction could be increased on the high seas if we had more destroyers, more U-boats, more submarines; in shore, more material.

(2) It could be increased were we able to employ the material we have got, close up to the exits from which the U-boats proceed on to the British lines of communication.

The first method, which we are now engaged upon, is bad strategy, for our forces are dispersed; the second method, were is possible, would be good strategy.

The Cabinet.—Why cannot the second method be employed?

The Admiralty.—Because our light craft cannot work off the German bases, since in those ports lie the High Seas fleet. Our craft might be able to work there for a few days supported by the Grand fleet, but we want to work there for several months.[1]

The Cabinet.—Since your first method of increasing the rate of destruction of U-boats demands time and more material—two things we cannot produce—we are obliged to fall back on the second method, which seems to demand as an essential preliminary the destruction of the High Seas fleet.

The Admiralty.—That is so.

The Cabinet.—Can the Grand fleet do it?

The Admiralty.—If the army cannot turn the German right flank and take the German coast line in rear, and if the Cabinet's opinion is that it is a case of neck or nothing, then the Grand fleet will seek out and endeavor to destroy the High Seas fleet. But success is doubtful, since the Grand fleet is neither designed nor trained to do this work.

* * *

The above phantasy very nearly became an unpleasant reality; there can be no doubt that we might have had to destroy the High Seas fleet to save our empire; and it is equally certain that our material was quite unsuited for the purpose.

What of the future? Are we likely to be faced with the same problem?

In 1914 there was a comfortable saying: it ran something like this, "*guerre de course*, or war on trade, can never win a war." It was not accurate, for the English forced the Dutch to their knees in the 17th century by cutting off the sea trade on which the Dutchmen lived; nevertheless, it was a comfortable saying in the ears of Englishmen who depended for their existence on overseas communications.

The exploits of the *Emden* shook it a little, but it perked up on remembering that "we lost more trade ships after Trafalgar than before, and still we won that war."

In February, 1915, the German system of U-boat *guerre de course* made its début.

The "saying" fell into a decline, and by April, 1917,[2] it was dead; heaven forbid that because we won the last war there should be a resurrection.

"War on trade *can* win a war *against England to-day*." Why was it then that the French in the 18th and early 19th century failed to make it do so whilst the Germans in the 20th century almost succeeded, and possibly only failed because they did not allow Tirpitz to have his way?

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[1] "The German fleet was the bulwark behind which the U-boat campaign grew up." (From a report of a speech by Admiral Lord Beatty at Liverpool.)

"The function of the High Seas fleet is to secure the U-boat bases and the approaches thereto." (Said by the captain of a U-boat to the writer in February, 1918.)

[2] In this month the U-boats sank 875,023 tons of shipping.

The situation in the 20th century differed from its predecessor in several important particulars. In the first place, the British islands have during the last 100 years rapidly become highly industrialized, and therefore more dependent for food and raw material on oversea supply. In the second place, Germany employed submarine cruisers which were not only harder to cope with than surface ships, but enjoyed the advantage of operating against our trade, while we were still busily experimenting in endeavors to discover methods by which under-water craft could be located and destroyed.

Modern practical submarine work dates from 1907; a similar point in anti-submarine effort was not reached until 1917. These ten years made a big difference, and we have every reason to be proud of the rapidity with which we recovered some of the lost years. If we take the figure 100 to represent either the tonnage, or the food and materials, which normally come to the British Islands in a year, experts can calculate what percentage of this figure would suffice as a bare minimum on which to feed the people in peace, or feed the people and supply the armies in a given war. The value of this percentage has unquestionably increased greatly during the last century.

In 1805 it may have been as low as 30 per cent, that is to say, we could have lost 70 per cent of our imports and still continued the war. In 1917 it was probably in the region of 60 per cent. There seems no reason to suppose that in the future it will get less, everything points to it rising. In any event there is no doubt that a certain *factor of safety* does exist, and that if our enemies can reduce our volume of sea imports below this figure we cannot continue the war.

Without guessing at actual figures, whose precise numerical value does not affect the argument, let us assume that in April, 1917, the factor of safety was "X." Then at that moment the strength of the structure was actually X plus DX, where DX was a diminishing quantity which the U-boats seemed likely to be in a fair way to eliminating within a few months. Of course they did not eliminate it; we pulled through, and in 1918 "DX" was a little bigger than "DX" had been in 1917. This fortunate circumstance was at least as much due to the hampering effects of politics on the *U-boat* war as it was to anti-submarine efforts, though the latter were very fine. In the future we cannot bank on enemy politics helping us.

* * *

I have tried to show in the preceding pages:

That though the British fleet exists for the purpose of destroying the enemy's fleet, it can only do so in the special case of the enemy fleet at sea.

That this fact has been felt to be a weakness in the past, and that efforts to remedy it all depend upon the addition of special material (and training) to the fleet.

That this addition has not been made in peace time.

That whereas in the Napoleonic wars the destruction of the enemy fleet in its base may be described as being then a desirable luxury, in the late war it nearly became an imperative necessity, and that in a future war it may become an imperative necessity.

That if the above conclusions are sound, they lead to the decision that the safety of the Empire demands a fleet which can insure the destruction of the enemy's main forces *wherever they may be*.

The possible lines of development which, if followed, would lead to such a fleet are considered in the second part of this paper.

Part II.—The problem to be solved is as follows.

"The enemy fleet is in a heavily fortified base; the destruction of that fleet is necessary in order to win the war."

Ignoring combined operations, which are outside the scope of this paper, a solution can be sought in two ways. Either we can attempt to destroy

the enemy in his base, or we can attempt to make him come to sea and accept battle with our seagoing fleet.

To destroy an enemy in a strong base can never be impossible, but its achievement may demand such expenditure on special material that it becomes uneconomic.

No doubt naval constructors could give us a fleet of curious, slow-moving, torpedo-proof, mine-proof, gas-tight, 40-inch armored, net-cutting, submersible monsters, capable of penetrating anything except a breakwater.[1]

But they would be built at the expense of the sea fighting fleet; we should still have a one-handed fleet and be no better, probably worse off, than we are at present.

Here we face the first difficulty, which is this: How can we give our present fleet a right-handed punch for use against an enemy in harbor without weakening the straight left it needs if the enemy comes to sea?

We need special material, but we must put forward modest demands. If this principle be agreed upon we are obliged to eliminate:

(i) Any idea of special long-range (100,000 yards) guns mounted in ships unless these guns are going to be equally useful in a sea battle. Their use against a fleet in harbor implies aerial supremacy over that harbor, and the chances are that as we are far from our base and he is at his, the boot will be on the other leg.

(ii) Bombardment from the air: If we intended to employ this method of destroying him, we should have to devote half our naval estimates to aircraft. Half the navy may be in the air in time, but we shall probably be in our graves or club armchairs before that happens.

(iii) The construction of a special fleet of harbor penetrators.

If the above are forbidden fruit, the only alternative, in the writer's mind, is the adaptation of chemical warfare to this naval requirement.

Gas (at present) does not attack material but personnel. In open sea warfare every effort is made to destroy material, since personnel are so tied to their material that the destruction of the ship usually involves that of the men.

In land warfare, the distinction between efforts to destroy material and those to destroy personnel are more widely separated.

The men who invented grape shot, langridge, shrapnel, and the machine gun realized that a very small missile knocked out a man, and that against exposed personnel 16,000 one-ounce missiles gave much better results than one 1000-pound shell, which might break up into a few hundred effective pieces.

The chemist has improved on shrapnel; he has given us gas with its immense number of projectiles in the shape of molecules. The density of the projectiles is such that several square miles can be brought under effective fire. Nothing in that area can hope to be missed by the gas molecules. Though they have a great disadvantage in their slowness of flight, and dependence on the wind, the point to bear in mind at this juncture is that the bedrock of chemical warfare is the immense number of man-killing missiles which can be diffused over large areas.

* * *

The strength of the position of a fleet in a defended base need not be labored, but it has one conspicuous weakness—as long as the fleet stays in that base it has lost mobility.

Naval history is so replete with the difficulties of the problems in which the British fleet has had to find the enemy, that it is evident that the knowledge to within a few miles of the exact position of our objective is a great advantage to us. If the whole problem we are discussing is looked at broadly, this knowledge solves half our difficulty.

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[1] The embryo of some such ship was used by the Italians in their attack on Pola, 14th May, 1918. (See R. U. S. I. Journal for May 1919.)

"We know he is in X. Y. Right. At him then!"

How much more encouraging this sounds than:

"We know he was at X. Y. a week ago. Right. Where shall we look for him now?"[1]

I suppose our present fleet to be as perfect an instrument for open sea fighting as can be built and trained to-day.

To that fleet I suggest adding a certain number of submarines fitted to discharge gas and a certain number of gas ships. Both submarines and gas ships would carry gas in liquid form. The employment of these vessels would be somewhat as follows:

Method A: The Direct Attack.—The main battle fleet occupies a covering position. The submarines get as close to the base as they can and discharge gas with an onshore wind.[2] The result will be that every man in the hostile fleet, every soldier in its forts, every workman in its dockyard, every inhabitant in the town (should there be a town) will have to put on a mask. Perhaps our gas beats their mask, perhaps it does not. Take the worst case and suppose the mask to beat the gas. Life in a gas mask becomes monotonous after some hours. I do not think dockyard maties or town councillors would like to spend 12 hours of every day in a gas mask. The C.-in-C. might find it rather trying after the tenth day. I believe we could make life so intolerable for that fleet that they would be driven to take the only step which would enable them to avoid the gas, *i. e.*, they'd have to move. They could only move one way, and that way would be to the open sea; we should get our battle.

Method B: The Indirect Attack.—The direct attack has failed; the onshore wind did not come up to expectation, or the gas submarines went up on minefields, or the one thing we never thought of unfortunately turned up, etc. The result is a fresh situation, which is dealt with as follows:

The main fleet moves a few hundred miles down the coast, leaving submarines off the enemy base. It takes up a covering position between the enemy main base and the flourishing commercial port of X. Y. Z.

The gas ships arrive off X. Y. Z.; only half-a-dozen little ships each of 4000 tons, and escorted by suitable light craft.

Six hours' notice to evacuate the town is given (if the enemy has been playing the game at sea), and then the gas squadron gets busy. It would probably be unnecessary to use lethal gas.

Put Liverpool in the position of X. Y. Z. One can imagine the hurried Cabinet meeting, the hasty reversal of naval policy, the telegram insisting on the fleet putting to sea to drive off the gas ships. . . . . In the middle of the excitement news is received that two vessels thought to be gas ships have just arrived off the port of P. B. X. . . . .

We should get our battle.

Conclusion.—All war problems revolve upon the question of overcoming or maintaining the defensive. In France, in the last war, both armies were up against this question. Looked at from the British side our army knew that until they could break down the German defensive system and destroy, or threaten to destroy, the German Field Army, the war would not be won.

To break down this defensive, two new things were brought into being:

1. Immense artillery power.
2. Mechanical warfare.

The army had to devise, make and test these things in time of war, when every moment was precious.

Though it is true the navy had to improvise the anti-submarine business, it was on the whole more fortunate, in that by the old methods it succeeded

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[1] Please forget all about the North Sea, and think of big areas.

[2] The Sailing Directions afford food for thought in connection with the direction of prevailing winds in various parts of the world.

in doing its share in the war. We may now hope for years of peace; these are the years in which to overhaul our methods.—*Royal United Service Institution*, February, 1921.

TRANSATLANTIC VISITORS.—The American Navy is still doing its bit in "clearing up the mess" which the war has left in the remoter parts of Europe and also in the Near East. The result is that its ships are frequently seen in our ports, and Uncle Sam's naval officers and "Jackies" still contribute a respectable quota to the transient population of our capital. Among the latest visitors to Gravesend were the new "flush-deck" destroyers *Sands* and *Williamson*, and a representative of *The Naval and Military Record* who took the opportunity last week to inspect the former vessel was courteously received by her commanding officer, Commander Ghormley, U. S. N. These flush-deckers have introduced a new fashion in destroyer design. They are big, weatherly ships, and those who sail in them speak enthusiastically of their sea-keeping qualities. The complement averages 110, including eight wardroom officers, and all on board are most comfortably housed. The United States Navy, like our own, has lost a large number of its best and most highly-trained men through demobilization, but if the destroyer crews are a fair sample, the ratings that remain are of excellent quality. It would certainly be difficult to find a cheerier and harder-working ship's company than that of the U. S. S. *Sands*. It is interesting to observe the remarkable difference which the recent modification of uniform has made in the appearance of American naval officers. Now that the single-breasted tunic, with its stiff stock, has given place to a double-breasted reefer very much after the British pattern, it is by no means easy to distinguish American from British N. O.'s at any distance, especially as the former seem to be discarding the mustache which their regulations, contrary to those of our service, permitted them to wear sans beard. The only striking difference in the two uniforms is that the American deck officer wears a star in place of the "executive curl." Nor is the resemblance between the two types limited to outward appearance. An hour's chat with a group of American naval officers leaves one wondering what on earth prevents two nations so much akin in ideals, thought, and temperament from "getting together" and working in double harness. Certainly, if the seafaring element had more voice in affairs on both sides of the Atlantic, reciprocal bickering would speedily give place to frank and cordial cooperation between the two peoples.—*The Naval and Military Record*, Feb. 23, 1921.

THE SHIPPING OUTLOOK.—The February number of *The Navy* contains a most timely and instructive article on "The Principles of Shipping," by Mr. A. M. Pooley, which should bring plenty of comfort to those faint-hearted people who have been sounding the death-knell of British shipping supremacy. Mr. Pooley is under no illusions as to the competition which the Red Ensign now has to face, but he shows very clearly that if we fail in the contest it will be our own fault. He mentions as a fact worth noting that the countries which had made a bid for, and ultimately missed, sea power, generally have their capitals situated inland, cases in point being Berlin, Madrid, Rome, Washington, and Paris. The sequence, although not chronological, is significant enough. He considers that the final element of success in shipping is the attitude of the government. Maritime development is nowadays the aim of many countries, but history teaches us that "silent sympathy" is the best attitude that any government can assume towards this industry. At the present time nearly every government except the British is subsidizing, regulating, or encouraging by other means the activity of its shipping. But, says Mr. Pooley, "a mercantile marine, while it may be legislated into existence, as occurred in the United States during the war, may equally easily be legislated into oblivion, as occurred in the same country before the war," and as may occur again if

Admiral Benson and Senator Jones have their way. "A flourish of trumpets and a vast expenditure cannot alter the course of nature. The attitude of a wise government towards shipping development should be to leave it alone and 'watch the other fellow.' Shipping is a business of natural growth, and any attempt to force its growth is bound, eventually, to meet with disaster. If a government discriminates against foreign ships, there will be international trouble. If it over-develops tonnage other industries must suffer." These be words of wisdom, and, incidentally, of comfort. As a commentary on the alarmist statements about the decline of British shipping which were current all last year, we may quote the latest announcement from Washington, according to which another few hundred vessels of the U. S. Shipping Board are to be withdrawn from service this month and laid up, with very little prospect of ever putting to sea again.—*The Naval and Military Record*, Feb. 9, 1921.

JAPAN

JAPANESE NAVAL POLICY.—Hitherto there has been little enthusiasm in Japan for the "naval holiday" proposals of which so much has been heard elsewhere, but signs are not wanting that the "non possumus" with which every previous suggestion of this nature has been met may soon become less emphatic. It is significant that Mr. Ozaki, a former member of the Cabinet, should have introduced a bill for the partial suspension of the Japanese naval program. The author of the bill was until lately a leading light of the Kensei-Kai, the party which has been most prominently associated with the big navy movement. It is true that a split has just occurred in the ranks of this faction over the suffrage question, in consequence of which Mr. Ozaki has ceased to be a member of it, but his move in favor of naval retrenchment suggests that one of the great political parties of the Empire is no longer throwing the whole weight of its influence into the scale against disarmament. Baron Hayashi, the Japanese Ambassador in London, has assured us that his country has no intention of setting the pace in naval competition. Her present programme is, he insists, a measure of defence natural to an island empire, but he adds that Japan would be only too pleased to join in any discussions between the League of Nations on the disarmament question. That she is unwilling to disarm before an international agreement has been reached is shown by the rejection last week of Mr. Ozaki's bill by a majority of seven to one. Undoubtedly there is a Chauvinist Party in Japan, which enjoys the support of the military caste and of the big industrialists, the latter being anxious to exclude Westerners from the markets and resources of China, while the former regard an aggressive foreign policy as the surest antidote for social troubles. It is but fair to add, however, that some of the most violent outbursts of the Japanese press have been provoked by the menacing tone of the Hearst newspapers in America and the uncompromising attitude of California towards Japanese immigration. It must be obvious to every thoughtful Japanese that his country cannot hope to compete successfully with the United States in naval shipbuilding, and that further efforts in this direction, so far from modifying the balance of power in favor of Japan, are likely to produce the contrary effect by giving a fresh impulse to naval construction in the United States. If only Tokio and Washington could reach an agreement on this subject, world-wide disarmament, or limitation of armaments, would follow as a matter of course.—*The Naval and Military Record*, Feb. 16, 1921.

LAWS TO RELIEVE JAPAN'S POOR.—Critics of Japan who think she has nothing on her mind but thoughts of territorial aggression would do well to consider the complexity of the problems that follow upon her great home expansion during the war, we are advised by some Japanese editors, who point with modest pride to three impressive pieces of legislation now in

process and sure of enactment "possibly with minor modifications." These are the Public Employment Agency Bill, the Home Supply Corporation Bill, and the Slum Improvement Bill. The Public Employment Agency Bill, as *The East and West News* (New York) informs us, aims to establish an efficient national system of employment. Such a government agency has long been contemplated and is now absolutely necessary because of the vast number of unemployed. The bills provides for public employment agencies in cities, towns, and villages throughout the country, which are to be directed by the local authorities. The local directors will receive instructions from the Central Board of Employment, to be established under the direct supervision of the Minister of Home Affairs. The government hopes through this legislation to set in motion an adjustable mechanism for regulating the demand and supply of labor all over Japan.

The Home Supply Corporation Bill is designed to help people obtain homes more easily, and this legislation is said to be imperative because of the fact that rents have mounted by leaps and bounds and the housing famine has become acute. The Tokyo *Yomiuri* tells us that salaried men and laborers must pay "one-third or even one-half of their income for house rent," and even when they are willing to pay so high a rent it is difficult for them to obtain a place to live. *The East and West News* explains that the housing bill is—

"A kind of special corporation law to be applied exclusively for mutually financing associations created for the purpose of building and supplying houses. Such corporations may be formed by a combination of 20 or more people having desire to obtain homes for reasonable sums. Each member shall pay a fixed sum of money for a certain period of time and get a house which he desires.

"The bill contains detailed regulation of the corporation safeguarding against possible fraud to which this kind of organization is susceptible. It is expected that upon the passing of the bill by the Diet the means of obtaining homes will become much more accessible to the lower middle class of people than heretofore."

The Slum Improvement Bill purposes general improvement of the slum districts and also stimulation to local authorities toward systematic campaigns for social settlement work. The operation of this bill will cost the local governments some money and also involves subsidy by the central government, and this informant proceeds:

"There are particular kinds of slums in all large cities of Japan where '*eta*' or discriminated class of people live. These people are segregated and detested by the other classes of Japanese, much as the negroes are segregated in some portions of the United States. The reasons fot the exclusion are diverse, but the principal one is the historical fact that '*eta*' belonged to a profession of killing animals and selling their flesh and hides at the time when Buddhism came in some 1500 years ago. Buddhism condemns killing of living creatures as the blackest of sins. Hence, when the religion was embraced by a large majority of the people, the '*eta*' were held as an abominable class. This traditional prejudice became fixed in the minds of the people and clings even to this day.

"Now these segregated people live under an entirely different standard of living from the ordinary Japanese, and constitute the lowest stratum of the society. It is the improvement of this particular class of people and their conditions of living that the bill is especially aimed at. It provides for plans for improving streets and alleys in these quarters, improving houses, establishing better system of sewerage and water supply, extending medical aid, promoting morality and education, and for general betterment of economic status of the people.—*The Literary Digest*, March 12, 1921.

JAPANESE NAVY.—Ever since the last autumn rumors have been afloat in London to the effect that a considerable part of the new naval program

which the Japanese Government adopted in July was to be executed in this country.

Only a fortnight ago a statement appeared, with all the semblance of authority, to the effect that Cammell, Laird & Co. had secured the contract for two battle cruisers, while Vickers & Armstrongs were said to have received orders for other ships of this type. Orders of this kind would, of course, be a perfect godsend at the present time, when British armor plate mills and gun factories, erected at enormous cost, are lying idle and incidentally eating up capital for their maintenance. But, unfortunately, the rumors have not been confirmed, and I am now able to state that they are premature, to say the least.

Captain S. Kobayashi, C. B., the popular Japanese Naval Attaché in London, has been kind enough to furnish me with a statement on the subject, and I cannot do better than quote his remarks.

"It is true," he observed, "that a certain amount of barbette and other special armor plate for certain battleships, together with a quantity of armor-piercing projectiles, have been ordered in England by my government, but so far I have no official information touching the construction of capital ships in this country. As you are no doubt aware, the present world-wide financial depression is felt in Japan, and the shipbuilding firms are experiencing a serious shortage of work; they are, therefore, most keen to secure any orders which may be available. Under these conditions I do not think that the Japanese Government would contemplate placing orders for the building of capital ships in a foreign country.

"It must be remembered, however, that the Japanese shipbuilding firms are still young in experience, and they may find it necessary to have some of the special material supplied from abroad. In this case, therefore, certain Japanese firms may have placed contracts with British firms for some special machinery or engines; but since this is a matter which concerns the Japanese private firms alone, it would be impossible for me to furnish particulars of the orders in question."

Guarded as this statement is, it appears to refute the rumors that battle-cruiser orders have been actually placed in this country. At the same time, there is a possibility that such orders will be forthcoming in the near future, owing to the fact that the Japanese shipbuilding and armament industry is not in a position to deal with the immense amount of construction represented by the new naval programme.

Four battleships and four battle-cruisers, with an aggregate displacement of 241,600 tons, are now under construction in Japanese yards, and eight additional capital ships, of still larger dimensions, have been voted by the Diet. Other construction now in hand or authorized includes 12 to 16 light cruisers and a very large number of destroyers and submarines. The execution of all this work would tax the resources of the most extensive and highly-developed industry, and it is certainly far beyond the capacity of the Japanese firms, in spite of the remarkable strides they have made since 1914.

Moreover, the government appears to be desirous of getting all these ships afloat within the next five or six years, in which case they will have no option but to farm out some of the work to foreign firms, and the high reputation which British shipbuilding enjoys in Japan is a guarantee that in such circumstances our own firms will be given the preference.

So far, however, no orders for ships have been received, though a certain amount of other work is being done there on behalf of the Japanese Navy. Messrs. Vickers, for instances, are manufacturing 7600 tons of special curved armor plate for the barbettes and conning-towners of the battleships *Kaga* and *Tosa*, and are also building several sets of 1200 brake horsepower engines for submarines, the boats themselves being on the stocks in Japan. Messrs. Hadfields are turning out several thousand armor-piercing projectiles for the 14-inch and 16-inch guns of the Japanese battle fleet.

These orders, welcome as they are, appear to be regarded as a promise of better things to come; and if that expectation is fulfilled the problem of what to do with our armor plate and gun-making plants will be solved, at any rate for the time being.

Twenty years ago Great Britain was the main source of supply for the Japanese Navy. Practically the whole of Togo's battle fleet at Tsushima had been built and armed in this country, and as late as 1912 Vickers launched the Japanese battle-cruiser *Kongo*. Since then, however, Japan has been able to meet her own naval requirements, though a certain part of the material and equipment of her later dreadnoughts was imported from Britain.

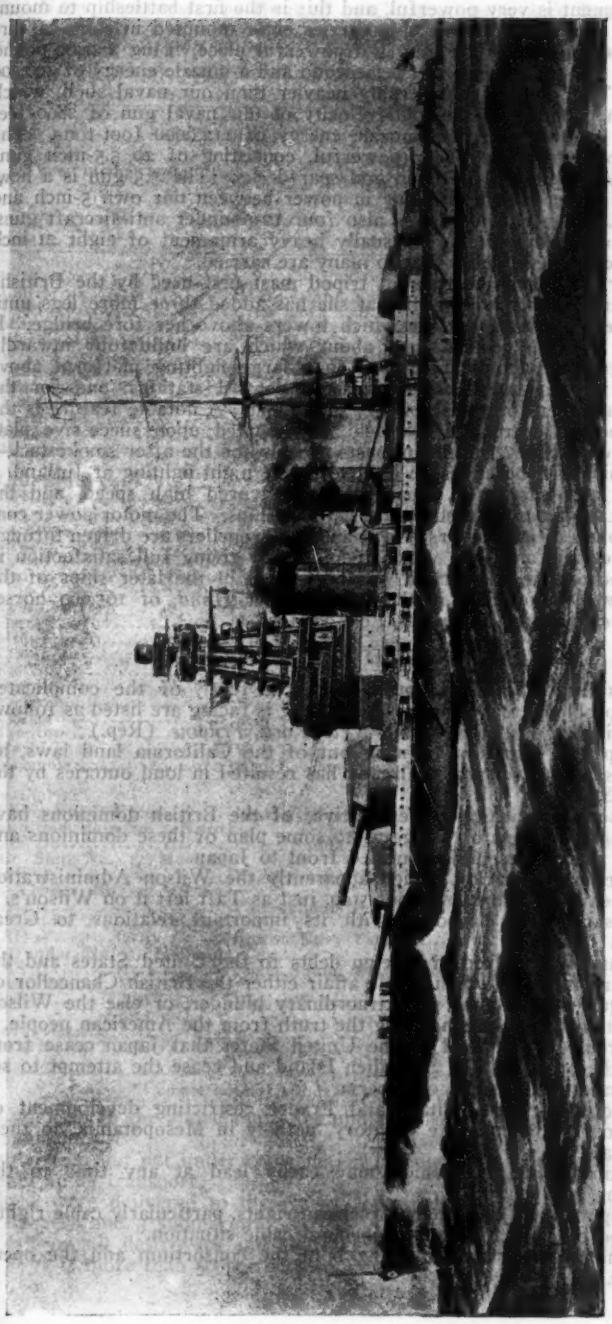
But she has now embarked on a naval programme which goes considerably beyond the resources of her own industry, and if the ambition of Admiral Kato, the Minister of Marine, to have all the new ships in service by 1926 is to be realized, the placing of large contracts abroad will be inevitable. In any case, I am told that British shipbuilders and armament manufacturers are hopeful that enough work will be forthcoming to tide over the difficult period which now confronts them.

It is of interest to learn that the two latest Japanese battleships to be built here, the *Katori* and *Kashima*, both launched in 1905, will sail for England next month. The *Katori* is bringing the Japanese Crown Prince, while her sister ship is to act as escort.—*The Naval and Military Record*, Feb. 9, 1921.

THE LATEST JAPANESE BATTLESHIP "NAGATO."—*The First Japanese Capital Ship to Include the Lessons of the Battle of Jutland.*—In view of the great public interest just now in the navies of the world, particularly in regard to the proposed reduction of armaments, the accompanying wash drawing of the *Nagato*, the latest Japanese battleship to be completed, possesses special interest. Although the modern battleships of all nations have reached a commonly accepted type, and are so generally similar in appearance that it takes a trained eye to recognize their individual silhouettes at a distance, the *Nagato* will be distinguishable at a glance by her remarkable five-legged foremast, with its many superposed platforms and fighting tops or, as they are now called, director stations.

The *Nagato*, which was authorized in the 1916 program and laid down during the summer of 1917, was proceeded with slowly during the war and has only just been completed. She is one of a class of four ships, of which the *Mutsu* is practically completed and the *Kaga* and *Tosa* were begun in January, 1920. The four ships represent the work of Japanese designers and constructors, and the fabrication has been done in Japanese shops and yards. This class of ship invites comparison with the four United States battleships of the *Maryland* class, since they are of similar tonnage and were authorized in the same year. The main armament also is the same, though the speed is higher. Not much is known about the armor plan, and it is a pretty safe guess that because of the higher speed and heavier motive power of the Japanese ships, their defensive qualities are inferior to those of the *Maryland*.

The *Nagato* is 660 feet long between perpendiculars, with a beam of 95 feet and a mean draft of 30 feet. It is probable that since she was built subsequently to the Battle of Jutland, the technical lessons learned in that engagement have been embodied in her construction, as they no doubt have been to a great extent in our own *Maryland* class. This means that particular attention has been paid in the submerged portion of the ship by the incorporation of anti-torpedo devices, though the beam would indicate that the bulge has not been adopted. The belt armor is believed to be not less than 12 inches, and the decks in the wake of the magazines have been strengthened as a protection against plunging fire.



THE LATEST JAPANESE BATTLESHIP "NAGATO."

Length: 660 ft.; *Beam:* 95 ft.; *Mean Draft:* 30 ft.; *Displacement:* 32,000–34,000 tons; *Speed:* 23 knots; *Armor Belt:* 12-inch, with heavy deck armor; *Armament:* eight 16-inch, twenty 5.5-inch; *Torpedo Tubes:* 8.

The armament is very powerful, and this is the first battleship to mount the 16-inch gun, of which the ship carries eight mounted in pairs of turrets forward and aft. The gun is a powerful piece, firing a 2460-pound shell with a velocity of 2500 feet per second and a muzzle energy of 106,000 foot-tons. The shell is considerably heavier than our naval shell, which weighs 2100 pounds, but the high velocity of our naval gun of 2800 feet per second gives it a greater muzzle energy of 112,fiooo foot-tons. The secondary battery is also very powerful, consisting of 20 5.5-inch guns carried in broadside on the main and spar decks. The 5.5 gun is a new, long-caliber piece, coming midway in power between our own 5-inch and 6-inch guns. The *Nagato* carries also four 12-pounder anti-aircraft guns, and she is credited with the unusually heavy armament of eight 21-inch torpedo tubes; but we doubt that so many are carried.

Japan early adopted the tubular, tripod mast first used by the British; and she seems to like it so well that she has added three more legs until we have the imposing structure which towers above her fore bridge. It consists of a large central mast about which are built four inwardly inclined legs, the whole terminating in a large fighting platform above which are the separate, enclosed director-control stations, one for the main and the other for the secondary armament. A notable feature is the great number of searchlights, which are mounted upon successive platforms both on the fore and main masts and also on the after smokestack—evidence, this, of another lesson learned in the night-fighting at Jutland.

In their later ships, the Japanese have favored high speed, and the *Nagato* and *Mutsu* are reported to be 23-knot ships. The motor power consists of turbines of 46,000 horsepower and the propellers are driven through reduction gearing, a system which seems to be giving full satisfaction in the large powers with which it has been used in the later ships of the British Navy, and notably in the battle-cruiser *Hood*, of 165,000 horsepower.—*The Scientific American*, Feb. 26, 1921.

UNITED STATES

PROBLEMS THAT FACE HARDING.—"Just a few" of the complicated diplomatic problems that Warren G. Harding is facing are listed as follows in a Washington dispatch to the *New York Tribune* (Rep.):

"The Japanese situation growing out of the California land laws, an attempt to smooth over which already has resulted in loud outcries by the California Senators.

"The discussions which representatives of the British dominions have been holding with Senator Lodge as to some plan of these dominions and the United States presenting a united front to Japan.

"The Mexican situation, which apparently the Wilson Administration intends to leave on Harding's door-step, just as Taft left it on Wilson's.

"The disarmament proposal, with its important relations to Great Britain and Japan.

"The situation involved in foreign debts to the United States and the interest thereon, about which whole affair either the British Chancellor of the Exchequer is guilty of an extraordinary blunder, or else the Wilson Administration has been concealing the truth from the American people.

"The peremptory demand by the United States that Japan cease from occupying the other half of Saghalien Island and cease the attempt to set up buffer states in the south of Siberia.

"The protest against Britain and France restricting development of natural resources of mandate territory, notably in Mesopotamia, to their own nationals.

"The Cuban situation, which may easily lead at any time to the necessity for intervention.

"The dispute with Japan over American rights, particularly cable rights, in the island of Yap, and also the general cable situation.

"The Chinese situation, involving both the consortium and the open-door policy.

NAVY DEPARTMENT—BUREAU OF CONSTRUCTION AND REPAIR

VESSELS UNDER CONSTRUCTION, UNITED STATES NAVY—DEGREE OF COMPLETION, AS REPORTED FEBRUARY 28, 1921

Type, number and name	Contractor	Per cent of completion			
		Mar. 1, 1921		Feb. 1, 1921	
		Total	On ship	Total	On ship
Battleships					
44 California	Mare Island Navy Yard	95.8	95.2	95.5	94.7
45 Colorado	New York S. B. Cpn.	68.	65.	66.7	62.6
46 Maryland	Newport News S. B. & D. D. Co.	95.	94.3	93.	92.2
47 Washington	New York S. B. Cpn.	59.5	52.1	57.6	49.8
48 West Virginia	Newport News S. B. & D. D. Co.	47.	36.3	44.5	33.2
49 South Dakota	New York Navy Yard	26.	17.2	22.3	13.5
50 Indiana	New York Navy Yard	21.4	12.6	18.2	9.4
51 Montana	Mare Island Navy Yard	17.5	10.7	16.6	9.5
52 North Carolina	Norfolk Navy Yard	24.1	16.1	21.8	13.4
53 Iowa	Newport News S. B. & D. D. Co.	14.1	10.5	13.1	9.2
54 Massachusetts	Beth. S. B. Cpn. (Fore River)	2.	....	1.2	....
Battle Cruisers					
1 Lexington	Beth. S. B. Cpn. (Fore River)	10.6	2.3	7.7	1.1
2 Constellation	Newport News S. B. & D. D. Co.	6.5	3.8	5.1	2.7
3 Saratoga	New York S. B. Cpn.	16.	8.	13.3	6.6
4 Ranger	Newport News S. B. & D. D. Co.	1.1	.5	1.	.4
5 Constitution	Philadelphia Navy Yard	3.	1.2	2.3	.8
6 United States	Philadelphia Navy Yard	3.	1.2	2.3	.8
Scout Cruisers					
4 Omaha	Todd D. D. & Const. Cpn.	88.4	80.7	88.4	80.1
5 Milwaukee	Todd D. D. & Const. Cpn.	81.6	74.	79.	72.7
6 Cincinnati	Todd D. D. & Const. Cpn.	73.4	60.9	64.2	54.2
7 Raleigh	Beth. S. B. Cpn. (Fore River)	47.5	30.6	42.2	26.3
8 Detroit	Beth. S. B. Cpn. (Fore River)	47.4	30.5	41.9	26.
* 9 Richmond	Wm. Cramp & Sons Co.	60.	....	59.	....
*10 Concord	Wm. Cramp & Sons Co.	59.	....	58.	....
*11 Trenton	Wm. Cramp & Sons Co.	40.	....	39.	....
*12 Marblehead	Wm. Cramp & Sons Co.	38.	....	37.	....
*13 Memphis	Wm. Cramp & Sons Co.	31.	....	30.	....
Auxiliaries					
Fuel Ship No. 18, Pecos	Boston Navy Yard (Oiler AO 6)	67 4	65.4	59.	57.
Ammunition Ship No. 2, Nitro (AE 2)	Puget Sound Navy Yard	99.9	99.5	99.8	99.2
Repair Ship No. 1, Medusa (AR 1)	Puget Sound Navy Yard	55.5	38.4	51.6	36.6
Dest. Tender No. 3, Dobbin (AD 3)	Philadelphia Navy Yard	50.3	50.	49.3	49.
Dest. Tender No. 4, Whitney (AD 4)	Boston Navy Yard	17.6	6.	15.	4.4
Sub. Tender No. 3, Holland (AS 3)	Puget Sound Navy Yard	9.5	....	7.8	....
Aircraft Tender, Wright (AZ 1)	Tietjen & Lang	48.	....	38.	....
Patrol Vessels					
Gunboat No. 22, Tulsa (PG 22)	Charleston Navy Yard	55.	39.	49.9	35.9

* Completion dates indefinite on account of strike.

In addition to the above there are under construction 21 destroyers and 38 submarines.

Authorized but not under construction or contract 12 destroyers, 7 submarines and 1 transport.

There were delivered to the Navy Department during February, 1921, 7 destroyers and 3 submarines.

Work on all destroyers and submarines (except submarines *V-1*, *V-2* and *V-3*) is more than 50 per cent complete.

"The Turkish-Armenian dispute, which Wilson has declared involves the whole question of attacks by small states encouraged by larger ones on Russia.

"The problem about Russian trade and recognition of Soviet Russia.

"The Irish situation.

"Panama Canal tolls, involving, if it is raised, as Mr. Harding promised, the reopening of the dispute with Britain over the construction of the Hay-Pauncefote treaty.

"The problem presented by American occupation or control of Hayti and other small Latin-American states.

"The dispute with Costa Rica over the purchase of the option on the Nicaragua Canal route, and with Salvador and Honduras over the American purchase of a naval base in Fonseca Bay, both disputes being involved in the Nicaraguan treaty.

"The Colombian treaty dispute, under which a treaty for the payment of $25,000,000 for alleged injuries in the Panama revolution is still pending.

"The question of American interest in the fixing of German indemnities.

"These are just a few of the problems, and do not touch on the biggest one of all, the question of an association of nations, to take the place of the League of Nations, except in that they complicate it and make it much more difficult of accomplishment."—*The Literary Digest*, Mar. 5, 1921.

EXCHANGING EDUCATIONAL FACILITIES WITH MEXICO.—The "Greaser" and the "Gringo" will perhaps look for more complimentary names for each other in the not distant future. If education succeeds where war and threats of war, with border raids as incidentals, fail to make two peoples friendly, Mexico and these United States may yet come to live in harmony. Business interests represented by various Chambers of Commerce, Rotary Clubs, and Foreign Trade Bureaus are furthering the proposal to establish exchange scholarships to "promote the exchange of educational opportunities between the two countries for deserving young men in college and university, commercial and technical courses, and apprenticeships in factories and business houses in the United States and Mexico." Fifteen institutions of collegiate grade have signified their willingness to establish from one to four free scholarships for Mexican students. The University of Texas has done more, and on December 28 received six Mexican young men for a four years' course. The present movement arose in the American Chamber of Commerce in Mexico, at the suggestion of Mr. W. A. Peairs, of Des Moines, Ia. "What we want," says Mr. Peairs, "is to have free tuition in business colleges, smaller colleges, and universities. We want business men in each locality to assist the Mexican boys by giving them part-time employment, so that they will realize that honest toil is no disgrace, and, what is still more, impress on them the true democracy of our land and its schools." After Mr. Peairs's visit to Louisville, Ky., *The Courier-Journal* of that city thus set forth his scheme:

"Education of young Mexicans in American universities, according to a plan worked out by the American Chamber of Commerce of Mexico, not only will cement trade relations between the United States and Mexico, but also will provide a panacea for Mexican political ills and the feeling of distrust between the two countries.

"It is hoped to bring between 1500 and 2000 Mexican young men, living in every part of the country from the United States border to the Isthmus of Tehuantepec, to America in 1921 to study in the universities and work in American business houses.

"The universities are being asked to exchange scholarships with Mexican schools, according to Mr. Peairs's outline of the plan. They are not asked to furnish anything more than tuition, however. The commerce chamber requests that American business men provide part-time employment for

the young Mexicans so that they may pay for their education, in addition to obtaining a thorough knowledge of American business methods.

"'Mexico City had a university when the Pilgrim Fathers landed at Plymouth Rock,' Mr. Peairs says, 'but wealthy Mexicans to-day send their sons to England and the countries of Europe to gain their education. It is not the sons of the rich people that we want, however. We plan to bring the sons of the peons here. They are ambitious. It is not realized generally how much they want education.

"'And we don't want young men to come here with plenty of spending money. They should have to earn their own way in order to learn America. We are going to try to scatter them out as much as possible. If they flock together and live in little colonies our purpose of teaching them as much about America as possible will not be completely successful.

"'I've been going to Mexico on business trips for twenty-six years, and I know from experience how much easier it is to deal with Mexicans who have been educated in America and know the country. Why, often it's just a matter of showing them where the dotted line is. You can imagine the benefit to American commerce when there will be thousands of Mexicans in the country who understand America.

"'The Chamber of Commerce under this plan will be able to furnish Mexican representatives to American business firms without the least difficulty. Suppose an American asks for a Mexican representative. They will send to him an apt young Mexican who will study at an American university and work for him without any extra expense. Then the Mexican will have the double advantage of knowing his employer's business and understanding the psychology of the Mexican business men.'

"The plan was proposed by Mr. Peairs at the first Mexican-American Trade Conference last February. It was greeted with favor, and a committee was appointed to take charge. The Mexicans, Mr. Peairs said, are enthusiastic. He has talked to General Obregon about the proposal and found the leader pleased with the plan."

The movement should receive help and encouragement everywhere in the country, says the Atlanta *Constitution*, "but it should appeal particularly to the South." For—

"Mexico is our next-door neighbor. The greater part, if not all, of Mexico's commerce with the United States, and much of its foreign trade, should pass through the market centers and ports of the South.

"We have much to gain by offering aid and encouragement to any movement that is aimed at Mexican welfare and the development and closer friendship between the Mexican and our own people. Aside from humanitarian motives, it means business to us.

"A thousand Mexican students studying in the universities of this country would work wonders in wiping out the animosities of the past.

"By all means let's have the Mexican students come over."

The Star, of Indianapolis, observes:

"The theory of the interchange is not new, although application of it to Mexico is an innovation. There is a great opportunity for development of the relations between this country and Mexico and the present is believed by those familiar with conditions south of the Rio Grande to be the psychological moment for launching a vigorous effort. The great difficulty in the way of trade expansion in Mexico has been a lack of understanding between us and the Mexicans that has aroused suspicion and prejudice on both sides."—*The Literary Digest*, Mar. 12, 1921.

MERCHANT MARINE

TRAINING AND MANNING OF OUR MERCHANT MARINE.—Returning to New York from a trip round the world as commander of *S. S. Westwind*, I have during my visits at different ports met with many incidents of such nature, that I feel it my duty to relay the suggestions incited by these experiences.

The suggestions I have hereunder recorded deal with the officers and crew of our merchant ships and how to man our ships in such a way, this with special refernce to our fast passenger and mail service, that there will be the least inconvenience, troubles and delays as: strikes, union interference, lack of discipline and many other things too numerous to mention, but which are all objectionable to proper management of our ships, especially in our close competition with foreign nations.

First.—All American merchant ships should be manned by officers and men enlisted in the U. S. Navy.

(a) A special branch to be established in the navy called the merchant marine branch of U. S. Navy.

(b) By enlisting officers and men in the U. S. Navy, merchant marine branch, they are thereby under the Navy Rules and Regulations, which seems the only way to maintain a disciplinary standard, necessary and most suitable to our modern and growing shipping.

(c) The officers and men enlisting in the U. S. Navy, merchant marine branch, should wear the regular navy uniform. A clear distinction between Naval Reserve officers of the merchant marine branch uniform and that of the regular naval officer should be manifested, and my suggestion is: That a one-eighth (⅛ inch) inch wide light blue silk thread or cord be stitched close to the upper (upper end) gold stripe on each sleeve. This suggestion is taken from the naval reserve officers' uniform in the Royal Swedish Navy. I believe such an arrangement would also please the regular naval officer, because he would otherwise feel an infringement has been made on the uniform he is most proud of, and for which he has gone through years of special training and schooling, and it seems by right that no one but a graduate of the U. S. Naval Academy should wear the regular naval uniform.

(d) All officers and men enlisting in the U. S. Navy, merchant marine branch, will be paid standard merchant marine wages, and kept on the steamship company's payroll he is engaged by, in the same manner as at present. He will therefore not receive any pay from the navy whatsoever, except if he has retainer or confirmation pay from the Naval Reserve to which he may belong.

Conclusion.—Every merchant marine officer and sea-faring man must belong to the U. S. Navy merchant marine branch, to be able to sail in any American ship, at least in ships of and above 2500 gross tons, but he will not receive any pay from the navy, but be paid regular merchant marine wages from the company he is engaged by and for the time only that he is actually engaged on board a ship.

(e) When not actually engaged on board a ship he resumes automatically his status as an ordinary citizen.

(f) Special provision and rules to be made for officers and men engaged in the U. S. Navy merchant marine branch, in regard to wearing of uniform: (1) Uniform to be worn on board ship at all times. (2) Civilian clothing allowed to be worn when going ashore and off duty ashore. Uniform also to be allowed on shore at the option of the wearer.

(g) The letters to be used for marking the branch to which a man belongs should in this instance be f. i.: U. S. Navy (M. M.), (D.) or (E.) or (P.), each of the latter letters indicating. Deck—Engineer's Department—Pay department (including pursers, clerks, stewards, messmen.)

(h) It will be clearly seen, that if such an arrangement is made as above suggestions, it will not only mean: Better disipline, uniform regulations for all ships, uniform standard and status of all officers and men, easy means of keeping track and record every officer and man, no delays caused by strikes, union troubles, as all hands are under strict naval rules and regulations, subject to court martial. It would also mean cleaner, better ships, cleaner and better and more attractive-looking officers and men, as everybody must wear prescribed uniform on all American ships.

Officers and men enlisted in the U. S. Navy (M. M.) should be called for any other service but in merchant ships, except on his own request.

(i) All officers and men enlisted in the U. S. Navy (M. M.) should be given three months' preliminary training on board regular navy ships, before being assigned to any ships. Every officer and man should also be compelled to serve three months every fourth year on board a regular navy ship; it should, however, be preferable that six months' actual service on board a regular navy ship should be required every sixth year for two first six-year periods, and after such service has been fulfilled no other regular service on board a navy ship should be required, except in case of national emergency.

(j) If the above suggestions should become law, the navy should always have a large reserve of officers and men to draw upon and depend upon. Men that are trained and used to Navy Rules and Regulations and naval routine. Every one of such men will always be ready on a moment's notice to pack his bag and report to the ship, ready for duty. Sufficient clothing always in possession of each man.

(k) Officers and men at present enrolled in the U. S. N. R. F. and having retainer or confirmation pay, should be transferred to U. S. Navy (M. M.) and continue to draw retainer and confirmation pay as before.

(l) Navy Rules and Regulations to be changed to some extent so as to be practically applied to the running of merchant ships. Details of such changes to be worked by a board whose members have had experience both in the navy as well as merchant ships.

(m) Pension system to be adopted, similar to the system prevailing in the Swedish Navy; *f. i.*, A naval reserve officer receives 300 a year after 25 or 30 years' service, during which time he also has fulfilled all obligations and service in the regular navy and has a clear record. Amount of pension varying according to last rank held before retiring. This pension to be paid to members of U. S. Navy (M. M.) by the navy, a special appropriation to be made for that purpose. Such a pension would serve to stimulate and encourage a man's desire to join the merchant marine branch, to make him *stick* and become a valuable asset both to the navy and the merchant marine.

The above suggestions have been made, because of the experiences met with during this trip round the world, when at various ports and in American ships; the captain of one ship was compelled to pay off the whole crew, part of crews being discharged in many other instances, and troubles of all kinds existing, a situation which is alarmingly increasing, not only menacing our shipping in general, but making a bad name for us in foreign countries. Such a condition is probably due to lax shipping and marine laws, due to which the authority of a master is almost nil, when most extraordinary demands are continuously made by officers and men, in all kinds of matters, which as a whole serve as a hindrance to our growing marine.

When this ship was at Honolulu last August, several of the men in the engineering department demanded being paid off. The ship was only in for fuel oil and I had a very short time in which to get new men so as not to delay the ship. A suggestion was made to me by the U. S. Shipping Commissioner at Honolulu, that if a recruiting station and a suitable training ship be stationed at Honolulu it would be no difficulty in getting Hawaiian boys to go to sea; they are most suitable to become seamen, easily trained and very adaptable, disciplinary, clean and willing. As Honolulu is a port where many of our ships call, and where ships are many times delayed due to discharging of men, I should think the question of Honolulu as a recruiting station for U. S. S. B. as well as U. S. Navy (M. M.) should be taken up without delay. A ready supply of trained men should then be always ready at that place to replace men being discharged there for some or other reason, or to sent to some other port where needed.—*By Lieut. Commander C. H. Hermance, U. S. N. R. F.*

AMERICAN SHIPPING.—By Senator Wesley L. Jones.—Good times in this country depend largely upon our foreign trade. So long as we produce a surplus this will be so. If we must depend upon the shipping of other nations and especially of our competitors for the transportation of this surplus we are at their mercy. The success of the farmer, the manufacturer and in fact all producers rest in their hands. If we cease to produce a surplus, if we reach the time when we must bring from other countries the things required for our own wants, we are then even more at the mercy of other people if we do not have the facilities to transport these things.

Surely we have not so soon forgotten the plight we were in when the world war broke out. We were then dependent upon foreign shipping to get the things we needed from abroad and to market our surplus. We found ourselves without these facilities. Freight charges soared. Our surplus products piled up at our terminals and could not get to market, even though enormous freights are offered. Railroad facilities were choked with freight seeking ships and embargoes were placed upon them, and the sidings throughout the country were filled with loaded cars. Industry was paralyzed and thousands of our people faced ruin—all because in time of peace we had not built up our shipping but had relied upon others for our ocean carrying. In the hour of stress we were at their mercy. Boasting of our freedom, of our independence and of our power, we were wholly dependent upon and our prosperity was wholly dependent upon the nations whose ships sailed the sea. We were at peace with them. They aided us all they could because they need our products. How much more disastrous it would have been if we had been at war with them.

A nation like ours without a merchant marine is an industrial vassal in peace and a helpless combatant in war. An adequate merchant marine is more important to us than a navy, even in war. Battleships may destroy battleships. They cannot carry trade. If we have no merchant marine our enemy need only keep their battleships at home and their merchant fleet away from our ports to work upon us untold suffering and ruin, and if that enemy is a country upon whom we would ordinarily depend for much of our ocean carriage.

Surely there is no American who does not know and admit the need of an adequate merchant marine. We all want one, but are we ready to do what must be done to get it? I wish I could do something that would lead our people to a fixed determination to have a merchant marine. It is no small thing for us to do. It is the biggest thing and the hardest problem to solve that faces us now. We must get the right kind of ships. We must get our people to go to sea and must train them. We must get American agents abroad. We must establish and build up business agencies and banking facilities. American marine insurance facilities must be created. All this must be done in competition with those firmly established and well-fitted by experience in all these activities, backed by their respective governments to the limit. Can we do it? We can, and we must. There is no human thing we cannot do if we will. We have the ability, the capacity, the energy, the initiative, the wealth and the power to do whatever human effort can do, if we will. What we need is the will to do. While recognizing the difficulties, we must counsel with our courage and not with our fears. If our people will determine to do this great thing regardless of cost or opposition we will succeed. It will cost money and take effort. We will suffer losses. We will meet with setbacks. We must endure discouragements. Our competitors will do all they can to keep us off the sea. They will scare us if they can. They will bluff us if they can. They will seek to discourage us. They will beat us if they can. I find no fault with them. I do not criticise them for this. Rather I honor them for it. They are looking after their own interests. I want to take a leaf from their book. I want our people and our government to look after

our interests as Britain and other countries and their peoples look after their interests.

We are not doing this now. There are many people and agencies in this country who are now doing more to prevent an American merchant marine than all direct foreign agencies. Some are acting unwittingly. Others I fear are acting purposely. Some are honest in their fears. Others are doing the will of alien agencies under the cloak of Americanism. The results of one are just as deadly as the other.

On the Pacific and in the Far East is a fertile field for the development of our commerce and our shipping. A short time ago several of our army officers were going across the Pacific to their various stations. They discussed shipping. Every one took the position that we could not establish a merchant marine. All agreed that the British had the experience, the training and the facilities and that they could do the ocean carrying cheaper than we can and therefore we should not contest with them to do it. On inquiry it is learned that before they started a United States army officer had given a lecture to their class in our War College and had taken this position. These men are probably at their various stations innocently but none the less effectively aiding the British marine. Just think of a United States army officer taking such a position in the face of the strong desire of this people to build up a merchant marine and of the experience we had only six years ago when any saving of the years by reason of cheap foreign carriage was wiped out in a few months and civilization hung in the balance while we built up in feverish haste and with prodigal wastefulness what we should have developed and maintained through the years. Our papers almost daily ran great headlines charging wastefulness, inefficiency and graft in the operation of the Shipping Board. The laying up of ships is made a feature and the loss in the operation of our shipping is pointed to as an evidence of our inefficiency. This tends only to discourage and dishearten our people. These things were inevitable with the conditions under which our ships were built and are more of a reflection upon our people and their patriotism than on the efficiency of the Shipping Board. The government is laying up ships, but why are we not told that private owners and operators are laying up ships, too. Nor are we the only people whose ships are being laid up. Besides our wooden ships we have laid up three or four hundred steel ships, but I am reliably informed that twelve or fifteen hundred British ships are also laid up. Shipping is not the only industry that is in a bad way. All of our industries will recover if we will just look to their future, bear with fortitude the ills of the present and determine to succeed. We must not let our indignation at what we think is the incompetency and graft of our public officials blind us to the need of the future.

A great legislator, moved with indignation at the apparent incompetency of the men of the Shipping Board, declared a short time ago, in substance, that not another dollar would be taken out of the treasury with his consent to run our fleet and that the board must depend on receipts from operations and sales of ships. That will be cheering news to our competitors. No more deadly blow could be struck at our merchant marine than to follow such a course. If that is to be our policy all that alien shipping interests need do is to sit tight and wait for the inevitable. We should get rid of inefficient, incompetent or dishonest agents if there are any, but we must keep our shipping going until world conditions improve, as they will. We must carry on this great enterprise just as private parties carry on their enterprises through bad times as well as good. If we are not ready and willing to do this we might as well quit right now trying to build up a merchant marine. No halting, hesitating, halfway policy will succeed.

Let me call to your attention one cheering fact. Before the war only eight or nine per cent of our foreign commerce was carried in American

ships. To-day we are carrying about forty per cent, or nearly half in American ships.

Alien shipping interests have close connections with our great business enterprises. This was one thing that grew up of the fact that we were depending for so many years upon them for our shipping. Through these relationships they seek to mold public opinion and direct the action of our leaders of thought and enterprise. It is a tremendous, insidious and far-reaching influence, and I have about reached the point that if I find any man or agency opposing our laws or belittling our efforts and magnifying our difficulties in building up a merchant marine I look for some of these influences. I do not urge you to do this, but I think just now it is a pretty safe guide for those to follow who earnestly want an American merchant marine. I proceed on the assumption which I think is a safe one) that foreign interests, private or governmental, will do all they can to keep up off the sea.

The people of this country are proud of the great city of New York and of the commanding position it holds in world affairs. No one desires to do anything to retard its growth or lessen its influence so long as that influence is directed toward promoting American interests. Above state interests, should be the interests of the nation. These should be made supreme in the heart, desire and effort of every American and of every American community. A feeling is taking root throughout the country that alien interests are seeking through New York to control the enterprises of this nation. They know that foreign shipping interests center here and that much of whatever adds to the foreign business of New York benefits alien shipping. They are beginning to feel that certain influences are directing the action of certain governmental agencies in such a way as to concentrate here the export and import trade of the country to the detriment of other ports as well as to the injury of the producers. They are beginning to suspect that foreign shipping concerns, acting through interlocking directorates, etc., are very largely responsible for such a state of affairs. They are beginning to wonder if they could not afford to pay a considerable sum for an American merchant marine that will sail from different ports to carry to foreign markets the products for export that are naturally tributory to such ports. The people cannot understand why it would not be better and cheaper to export or import from other ports where car and ship meet than to send cargo from ship to the car or from the car to the ship as it does from New York to interior points hundreds of miles away. I was told in Newark the other night that it costs $50, a car freight from Pittsburgh to Newark and $50 from there to the ship in New York harbor. That is a burden on commerce that ought to be removed. The people of Newark urge the improvement of their part of New York harbor to save that expense. They urge it as a national benefit. It will be a national benefit, but it will be a greater national benefit if our export trade can be relieved of that burden and at the same time be largely carried in American ships, and if, to do that, much of our commerce must be sent to other ports, this should be done and American ships made available there to carry it. The American people would like to see in New York that intense American spirit that we must have to build up an American marine. We want to see the great papers of New York urging unity among our people. We want to see them urging their support and the enforcement of law, whether relating to shipping or otherwise. We want to see them urging us to stand by our rights and the using of the measures that are necessary to prevent discriminations against us. We want to see them urging the people to be willing to sacrifice and not be discouraged at losses until our merchant marine is established. We want to see them urging the people to look to the future and not fill their columns with mistakes of the past with relations to our ships. In a word, we would like to see all the great papers of New York and the heads and leaders of great enterprises in New York express their faith in the ability

of our people to build up a merchant marine and to urge their support of every measure that may be deemed necessary to secure it. Let every American do his duty and insure for our flag a merchant marine commensurate with power, wealth and needs of this great nation.—*The National Marine*, February, 1921.

CONDITIONS OF SUCCESS IN THE MERCHANT MARINE.—Since the Spanish War, that is to say, for nearly a quarter of a century, there has been a more or less persistent effort to awaken the United States to the need for a merchant marine. The steady, and in late years phenomenal, growth of our foreign trade necessarily gave increasing emphasis to this movement. Before the war, it was estimated that we paid out about 300 million dollars per year in freight charges to foreign-owned shipping companies, and it was urged that if we had our own ships, this large sum of money would be diverted to the United States.

To-day we own such a fleet, but, unfortunately, its profitable operation is handicapped by shipping laws which impose such a heavy handicap upon American ships that they cannot possibly compete with those which fly a foreign flag. This is true, in spite of the fact that the general increase in wages throughout the world has brought this element in the cost of ship operations well up to the American level. Thus, thanks to the laws governing the operation of American ships, our splendid new merchant marine finds itself handicapped by having to carry much larger crews than its competitors. The accommodations for our seamen are more spacious and comfortable, and as to the way they are fed, the menu in the fo'castle of some of our ships would make many a city clerk or mechanic green with envy. This generous provision for the American seaman, so far as health and bodily comfort are concerned, is all to the good and will meet with approval; but anyone who is familiar with the problems of shipping operations will realize that this advancement of the conditions of housing, food and work imposes such a handicap upon our ships that, if we are to compete successfully with foreign-owned ships and to carry all of our own trade and a reasonable share of the trade of the world, it will be absolutely necessary for Congress to make good the difference in the shape of a very substantial annual subsidy from the national treasury.

Either that, or our shipping laws must undergo a drastic revision.

Hitherto, those of us who have striven to awaken the United States to the commercial and naval advantages that would follow from its possession of a powerful merchant marine have found that the mere mention of the word "subsidy" has acted like a spark in a powder magazine, except among the peoples who live along the seaboard and have an intelligent and sympathetic understanding of the shipping question. There is this difference, however, between the situation to-day and then. Formerly, we possessed no merchant marine. To-day we possess a great fleet composed largely of recently-built and thoroughly up-to-date freighters representing, so far as the one-half of it owned by the Shipping Board is concerned, an outlay of about four billion dollars of Uncle Sam's money.

It is certain that matters cannot go on as they are. To-day the operation of these ships is a losing proposition. We cannot go out of business, for one reason because nobody in these times of terrific depression and abnormally low freights would care to buy our ships at any reasonable figure. That being the case, what does the nation wish to do with this splendid property? Are we willing to sell the ships for a mere fraction of their cost? Shall we let them rest at moorings? Or shall we bring a little national pride into the matter and send these vessels, well equipped and manned by American crews, to display the American flag on all the seven seas, with the assurance that the taxpayers of the country are, to a man, behind the great venture and will cheerfully make good a deficit which is largely due to world conditions over which we have no control.—*The Scientific American*, Feb. 19, 1921.

AERONAUTICS

AERONAUTICS IN 1920 IN GREAT BRITAIN.—A general review of events of the past year, of which the part referring to commercial aeronautics is of particular interest.

From an examination of results obtained on the mail service from London to Paris, it would appear that out of 391 flights 298 (76 per cent) were completed without a delay of more than three hours. In 16 cases the flights were completed during the day on which they were started, but without a delay of more than three hours. In 77 cases the flights were either completed on the following day, not completed at all, or not started.

Railway passengers would probably have just cause to complain if one train in every four on a certain line between two cities failed to make the trip with a delay less than three hours.

It has also been found that aerial transportation both of passengers and freight is still very costly as compared with other methods. The main reason, however, why the public distrusts aerial transportation is on account of the impression of danger.

Turning to the records of the past year in England it is found that during the 17 months from May, 1919, to September, 1920, according to Air Ministry statistics, 100,285 passengers were carried in England in machines licensed for civilian flying. In this period seven pilots and eight passengers were killed in air accidents, and 13 pilots and 15 passengers were injured. The casualty rates per thousand passengers carried were thus 0.07 pilot and 0.08 passenger killed, and 0.13 pilot and 0.15 passenger injured. If the same rate of accidents prevailed on British railroads 140,000 passengers would be killed each year and over 260,00 injured, while in something like three months all the engine drivers in England would have lost their lives. Admitting that such a comparison may involve gross errors, the margin against the safety of flying is still quite great.

As regards the status of production, the Sopwith Company went into liquidation, the Aircraft Manufacturing Company was absorbed by another concern, while the British Nieuport, the General Aircraft Company, the Grahame-White and the British Aerial Transport Company have practically closed the doors. The Vickers, Ltd., has been doing some work on training machines and on an order from the Chinese Government. Several companies, however, are fairly active in developing new types.—*Mechanical Engineering*, March, 1921.

NEW 1000 HORSEPOWER AERO ENGINE.—*London*.—According to *The Evening News*, a powerful new Napier aero engine, called "The Cub," which, it is claimed, will revolutionize air travel, has undergone successful tests. It is an 18-cylinder engine of 1000 horsepower, and is intended for use by the Royal Air Force.

On its test the engine gave 1057 horsepower and was run for 20 hours. It weighs just under a ton and cost about £5000. It is understood that two "Cubs" are to be fitted to the *Titania*, a large flying boat which is being built by the Fairey Aviation Company. The *Titania*, says *The Evening News*, will have a range of about 1500 miles, and in wartime would carry crews of about ten. If adopted to civil use it probably could accommodate 50 people.

The paper declares that the advent of "The Cub" engine opens up possibilities of regular daily transatlantic service with giant flying boats of 5000 horsepower, carrying 250 passengers.—*The Aerial Age Weekly*, Feb. 14, 1921.

PREPAREDNESS IN THE AIR.—A business man who has insured his factory for many years does not complain that he has paid premiums for nothing because there has been no destructive fire in his building; nor, if he is a practical man, does he consider insuring his property for $10,000 when it is worth ten times as much. Congress does not look at insurance of the

country against the waste of war as sensibly. Constantly are heard complaints that too much money has been spent upon the army and navy for national defense, and when appropriations are wanted to equip a branch of the military service adequately a half or a third is allowed, no matter how good a case is made out for more. Thus the country carries less insurance than it should have, which is bad business.

The House Committee on Appropriations has recommended that $19,200,000 be allowed by army aviation, although Brig. General William Mitchell, Assistant Chief of the Army Air Service, had asked for $60,000,000, of which $17,000,000 was to be spent to equip units with modern aeroplanes. "Those we have now," he told the House Military Affairs Committee on January 4th, "are obsolete, old and becoming unsafe." There was such wastage during the war in building American aeroplanes on a colossal plan which proved to be a shocking failure that Congress is suspicious when the development of the air service of the army or navy on a modest scale is urged now. And members of Congress, of whom drastic economy in most things is expected, are prone to cut down every estimate asked for with small regard for the need of the appropriation. Even when there is crying need for money for the upkeep of an established and meritorious institution the knife goes through the estimate just the same, often leaving it a remnant. If the appropriation wanted is for national defense, the danger of another war is declared to be remote. Little attention is given to the wisdom of full insurance.

House committees may not accept General Mitchell as the most eminent authority on military aviation, and they may be disposed to turn to others for information about naval aeronautics, but in his appearances before the Military Affairs Committee early in January and the Appropriations Committee last week he surely qualified as an expert both at the front in France and since the war as Assistant Chief of the Army Air Service. What General Mitchell told the committees about the offensive and defensive power of the aeroplane on sea or land was not new, although more than one Representative seemed to hear it for the first time. Unfortunately there are few members of Congress who make a study of war inventions and preparedness. At the hearing early in January General Mitchell stated that the French were maintaining a force of 3000 land planes, and that the British, besides keeping up a formidable army flying corps, were acquiring ocean aircraft carriers and developing machines to fight above the water, while the United States lagged behind in aviation. The committees he addressed listened to illustrations of war in the air with wonder or incredulity. How great cities might be gassed from the sky by planes brought to the coast on aircraft carriers, unless there should be a defensive force to drive the enemy off, should have made a profound impression in the telling.

All the horrors described by General Mitchell, America may experience if other wars are to be waged and preparedness has been neglected. He pleaded with his hearers for a demonstration of what bombing planes could accomplish in attack upon an obsolete war vessel selected for experiment. That may be the business of the navy, but certainly one of the old battleships of the Spanish War could be spared for a thorough test. And other demonstrations of the destructiveness of bombs dropped from the air would be educational. If Congress can be made to understand the offensive power of aircraft on land and sea, adequate appropriations may not come so hard.—(Editorial in *N. Y. Times.*)—*Aerial Age Weekly*, Feb. 14, 1921.

GENERAL MITCHELL ON THE AIR SERVICE APPROPRIATIONS.—Brig. General William A. Mitchell, Assistant Chief of the Army Air Service, made a plea before the House Committee on Appropriations January 28 for adequate funds to develop aviation as a means of military defense, especially of

the coast cities. The committee in the Army Bill which was reported recently, however, recommends the appropriation of only $19,200,000 instead of the $60,000,000 which had been asked.

General Mitchell insisted that the aeroplane had become so much superior to the battleship that a well-balanced military program must include a large aerial force to be effective in the next war. He said that a sufficiently large force could be formed and equipped in three years at a cost of $45,000,000, which represented no more than the cost of a battle-cruiser.

General Mitchell wanted the committee to recommend the use of the former German liners *Leviathan, Von Steuben* and *Agamemnon* as aeroplane carriers. With these fast ships carrying an air force, he said, they could be quickly carried to any zone of operations. With these ships equipped the entire Atlantic Coast could be well protected, he said.

"The vulnerable part of our country is from the Chesapeake Bay up to Boston, and from New York to Chicago," said the general. "By having an air force ready for action somewhere in New Jersey you can reach any part of that area within two or three hours, whereas you could not do it in less than a day or two with railway guns, and then they could have little effect. You must remember that it takes an hour at least to put railway guns into firing position and we can go 110 miles an hour with our bombardment aeroplanes, much more with our pursuit. We can shift our air forces within 25 to 30 flying hours from the east to the west coast, and from the North to the South in the same proportion of time.

"You must remember, also, that battleships cost $45,000,000 each, and we can build a thousand aeroplanes for the cost of each battleship.

"The whole training of the navy is that the armored ship is mistress of the sea, whereas actually it is just as helpless as the armored knight was when firearms were brought against him."

General Mitchell said that 600 aeroplanes—60 per cent pursuit, 20 per cent attack, and 20 per cent bombing—would be sufficient to protect the Atlantic Coast, while the Pacific should have the same number. As a protection for the land, 1200 other planes were needed, he said.

The officer asserted that, with the improvements in aviation and bombing, "any ship in existence can be destroyed to-day." He told how in a test attack with bombs on the old battleship *Indiana* aircraft 5000 feet up made 11 per cent of hits.

Explaining the use of gas against cities, General Mitchell said:

"We believe that in the next war gas might be used by a barbarous foe on the centers of communication. We know just how much gas has to be put down on these centers to interrupt communication. Take New York and an area in the vicinity ten miles by ten miles. If two tons of crying gas are dropped by aeroplanes or airships there once in eight days, it will make everybody wear gas masks and goggles.

"If we want to keep that place covered with mustard gas, we can put down 70 tons once in eight days and everybody will have to protect themselves against mustard gas in that area. If we want to kill everybody in that area and use phosgene, we have to put down 200 tons of phosgene once in eight days and it will keep that area covered. All you have to do is to go over that area once every eight days and keep it inundated with gas. The only protection against such a procedure is protection in the air."—*Aerial Age Weekly*, Feb. 7, 1921.

APPROPRIATIONS FOR NAVAL AVIATION.—Following is a statement made by Capt. T. T. Craven, Director of Navay Aviation, before the Naval Affairs Committee of the House of Representatives:

The committee has before it an analysis of the estimates for naval aviation for the fiscal year 1922.

The estimates are divided up and analyzed as has been the case for the past two years and under the same subheads as before.

The Department submits a request for a total of $35,000,000. Considerable progress in fleet aviation has been made during the past year despite

the difficulties connected with all naval operations due to shortage and changing of personnel which have interfered with training everywhere. In the Pacific the aviation activities have been based largely in the San Diego region, where a fine climate and a shore base near to the drill ground for ships has materially assisted operations. The Atlantic Fleet has operated in the West Indies and also on our own coast, and has had conditions not as favorable as those experienced by the Pacific division of the fleet. There has been constant effort to make aviation a fleet activity. Difficulty has been experienced because of the absence of vessels capable of adequately caring for aviation interests. The *Shawmut* and the *Aroostook*, two mine layers, have been continued as aviation tenders and have given excellent service in that capacity, despite the fact that they are not fitted for this work and have simply been loaned by the mine force to aviation. If these two crat had not been with the Atlantic and Pacific fleets, naval aviation would have had to continue to base its efforts entirely upon the shore. In addition to the *Shawmut* and *Aroostook* acting as mother ships for the large aeroplanes which now accompany the fleets, the destroyers *Harding* and *Mugford* have been loaned to the two fleets as tenders for groups of large flying boats of the *NC* type. In the Atlantic fleet a mine sweeper, the *Sandpiper*, has also assisted as a tender for the purpose of aviation.

Four battleships in each fleet have been fitted to convey planes and each of these ships has been equipped with two heavier-than-air machines, which they have flown from the turrets. A number of vessels of various classes are equipped with kite balloon winches and are prepared to operate knife balloons. A kite balloon division has been organized in the Atlantic and in the Pacific to continue development to the kite balloon operations.

While material progress has been made with fleet aviation, it must be clearly understood that without the conveniences and the machines permitting the development of aviation afloat with a minimum of effort and inconvenience to ships, the progress of molding aviation into the naval establishment afloat necessarily will be slow.

I believe I am correct in stating that the difficulties for the sailor who flies are as much greater than those of the flyer over land as is the case with all of the other highly technical operations which a seaman undertakes by comparison with the work of the soldier. The development of military and naval aviation came about during the World's War and during that struggle the land operations of aviation were carried on intensely and constantly. The major effort of naval aviation was the suppression of the submarine and only towards the close of the struggle did it find a place in the fleet. The supremacy of land aviation put its stamp upon naval thought and until now the effort has been to improvise for naval purposes machines and tactics developed primarily for use over the land. Even the type of machine to be employed from ships cannot be the same as that best employed from shore. Those who are unfamiliar with naval subjects and the naval problem cannot understand this idea, which is in direct opposition to the view that a united Air Service is either practicable or desirable.

The aviation service which the navy desires to-day, and which it must have, is an arm which will assist it to defeat the enemy at sea. This is its paramount present-day essential. In so far as this detail is concerned, and regardless of future developments, the matter now is purely a naval one which the navy alone is competent to handle.

Because of the stress given to land aviation, the development of the land plane and of aviation tactics over the land in conjunction with troops has progressed far beyond the uncertain stage of experimentation. In the combined service which has been developed in England, the preponderance of experience and of skill and technical talent rests with the branch, by far most numerous, composed of flyers who have wone their laurels over the land. Consequently, the attempt has been to compromise and to adapt the land type of machine to naval purposes. Development has been slow

for two reasons: first, because Great Britain has two services in the same ship occupied with a common problem. It is not difficult to understand why progress has been impeded as a result of this arrangement. A second obstacle has been that incidental to the attempt to compromise the land type and to improvise the machines for ships' use rather than to attack the problem of the design of a machine for overseas work directly, which is distinct and separate from that involved in the design of land machines. There are certain principles which must be embodied in machines to be used from ships. The first is (a) flotation, which provides reasonable safety for the pilot and for the machine. Unless flotation is supplied which insures reasonable safety, the development of the tactics of aviation for naval purposes will not proceed, as the commander-in-chief and the commanding officers of vessels employing aircraft will not wish to hazard the aviation personnel in developing the tactical usefulness of aviation in time of peace and in studying the tactical employment of this arm. Consequently, interest in aviation and the application of aviation, in so far as the navy is concerned, cannot be obtained unless this characteristic is given to naval planes. An effort to compromise the land type of plane by fitting it with air bags for work over water has not been satisfactory as a means for fulfilling naval requirements.

A second quality essential for naval planes is (b) ruggedness and dependability, capable of being easily and quickly taken down and assembled, and when taken down, capable of compact stowage.

The conveyance of planes on the decks or turrets of ships adds one more mental burden to the great load carried by the captain of a naval unit. Planes carried on decks or turrets are very much in the way and one cannot expect to find planes in general use from various types of ships until machines have appeared which can be taken down easily and stowed inboard out of the weather and in a way in which they do not interfere with ship activities. It would seem that we must look to metal as material for assisting us to obtain this characteristic. Features which permit the quick taking down and assembly of planes are of far greater importance to the navy than to the army.

The third attribute to be incorporated in a naval plane is (c) ability to fly from a vessel, either directly or assisted, and to land on the deck of a vessel or in the water. The necessity for this characteristic is self-evident and in order that planes may be carried in different types of vessels it is essential that they may get away from the ship with a very short run or that a machine such as a catapult be supplied by which they may be projected into the air. A plane must be fitted to land on a deck or on the water. The land flyer is not concerned with these details.

A fourth attribute is (d) low landing speed. It can be readily seen that the closer the speed of a plane approaches the speed of a plane carrier—the ship upon which she desires to land—the easier a landing becomes upon the deck of such a vessel. A plane with an excessively high landing speed cannot land upon the deck of a carrier. The importance of low landing speed is supreme for planes to be conveyed in ships of the carrier type.

Having accepted the four above-mentioned characteristics as essentials, we then have a fifth which must be included in order that a machine carried by ships may serve a useful end. Such a plane must be (e) capable of conveying and of usefully applying military power. This involves performance, ability to communicate, and the employment of weapons.

It is evident that these characteristics cannot be secured without sacrifice to some degree of the high performances now given to the plane of purely a land type, but the navy must accept this penalty in the aviation arm as it does in all the arms conveyed in surface and subsurface vessels.

If one considers the five characteristics enumerated above and has knowledge of the conditions of the art as it exists to-day, it becomes evident that the naval problem is far from solution and it is seen that the time for standardization in so far as naval types are concerned is far in the future.

In other words, development of naval planes can only be carried on experimentally and it is of vital importance that the operator and the designer work closely hand in hand. Standardization is as yet impossible. The proposition to combine the production of machines for the army and navy therefore is illogical and can only result in delaying the naval branch in its effort to acquire the apparatus which will permit it to definitely give to aviation the place belonging to it in naval affairs.

Steps to Be Taken for the Procurement of New Types of Machines.—The following steps must be taken in order to attack directly the problem in hand by the navy for the procurement of machines adapted to its use:

(1) Encourage designers to develop planes suitable for naval purposes, through competition or otherwise.

(2) Encourage manufacturers to produce planes of different sizes incorporating the above requirements, through contracts.

(3) Improve and augment the experimental facilities of the aircraft factory and enlarge the technical designing force.

(4) Investigate and purchase abroad any types of aircraft which seemingly are well adapted for our purposes.

The development has proceeded along the lines indicated above. The lack of technical designers is felt keenly, particularly as many reserve officers who were employed in work of this nature have left the service, and with the departure of each one an unfilled vacancy in an important field remains. It is earnestly hoped that the limitations in regard to the amount which may be spent for classified and technical employees may be increased in order to permit the navy to proceed with the important work in hand. The solution of our problem has been retarded for lack of a carrier with which to carry on our experimental work. The conversion of the *Langley* (*ex Jupiter*) will be completed during the coming spring and when that vessel become available we will be able to make a start toward the solution we desire. A bigger and a faster ship than the *Jupiter* must be provided, however, before we can hope to attain final results.

The conversion of the *Wright* has been delayed and that vessel will not be ready for many months. When commissioned the ship will serve a most useful purpose as a base or tender for large seaplanes and for a kite balloon unit.

Funds for experimental work should not be curtailed, and pending the development of machines best adapated for use from shipboard planes not so excellent for naval purposes must be supplied in sufficient numbers to permit the development of organization and skill of personnel.

The personnel of aviation during the fiscal year 1922 is expected to be about 800 officers and 7000 men in the navy and 124 officers and 1100 men in the Marine Corps. At present a total of 631 officers are employed on aviation duty, of whom 362 are aviators and 53 student aviators. We have a total of 60 heavier-than-air and lighter-than-air enlisted pilots and a total of about 7200 enlisted men employed in aviation duty, of whom 3000 are at the Training School at Great Lakes.

A detachment of 15 officers and 45 enlisted men is on duty in England in connection with the construction of the rigid being manufactured for our naval service. This contingent is being instructed in the operation of rigids by the British. The completion of the ship has been retarded somewhat, as has also been the hangar intended for her reception in this country. It now looks as though the vessel would be completed in March and the hangar at Lakehurst would be ready for occupancy on July 1. It is probable that the ship will make the passage across the Atlantic early in July.

During the year shortage of personnel made it necessary to place the air stations at Chatham and at Cape May on an inoperative basis. These stations have been closed and placed under caretakers.

The station at Rockaway has operated throughout the year. The amount of money spent at this place has been kept low and nothing has been spent

on public works beyond what was absolutely necessary for upkeep. The matter of the acquirement by the government of the land on which the station stands has been taken up with the authorities in New York, but no arrangements have been consummated to this end.

It is evident that it is of great importance to the government to preserve aviation facilities in the neighborhood of large centers of population. Only through the maintenance of such establishments interest in flying on the part of many individuals who would be immediately useful as flyers in the event of war can be sustained and a reserve of aviators perpetuated.

There has been considerable progress in the completion of the station at Hampton Roads, which during the next year will become our important aviation operating base on the Atlantic Coast.

There is no aviation station south of Hampton Roads within the continental limits of the United States, with the exception of the school at Pensacola. The activities at this place have been augmented considerably during the past few months because of the larger classes which are now being sent there made up of officers of the regular navy. This is probably one of the most active flying schools in the world.

A small station at Coco Solo in the Canal Zone, established during the war, has continued to struggle on with the limited conveniences supplied during hostilities. The importance of supplying adequate facilities insuring the protection of the Panama Canal would make it evident that a considerable sum should be devoted to the improvement of the aviation facilities in the Canal Zone in the near future. Better provision should be made for the housing of personnel station at this post.

On the west coast, San Diego has been a very active center during the past 12 months, and the importance of this point will increase during the coming year. Up to the present no decision has been reached in regard to the site for the rigid hangar for the construction of which money was appropriated by Congress last year.

It is expected that contracts for the establishment of the station at Pearl Harbor, authorized by the last Congress, will be let in the near future.

The Great Lakes mechanics' school has continued to fill a most useful rôle and is engaged in the training of aviation mechanics. Every one who has visited this institution has been impressed with the excellence of the course given to young men sent to this station. I believe it to be one of the leading, if not the leading, manual training school in the world. The only flying facilities at Great Lakes are those supplied during the war by private contribution, and it would seem most desirable that a hangar should be erected at this place which will permit flying in this locality. The Department has been seriously embarrassed during the past year because of the lack of facilities in this neighborhood where there is little that can be supplied reserve officers for the purpose of continuing their flight exercises and flight training.

The development of the torpedoplane is being undertaken seriously by the Navy Department. In order to carry on this work it is necessary to have flying facilities at places where it is convenient to run torpedoes. During the past year we have endeavored to carry on torpedo work at Yorktown, but in order to insure the progress which we desire, the Bureau of Ordnance is very anxious that facilities permitting the use of aviation should be created near the torpedo station at Newport.

It will be noted that no money has been requested for seaplanes, as it has been assumed that the planes left over from the stock accumulated during the war will be available for another 18 months. It costs a considerable amount to recondition these machines, but the large boats on hand are well worth this expenditure.

In the estimates presented to the committee, it will be noted that a total of 67 heavier-than-air planes are requested for the navy and 61 planes for the marines. This is a very conservative number; certainly it would seem impossible for us to do with less, and were it not for the large number of

seaplanes on hand which will also be utilized, a far greater number of heavier-than-air craft than the 128 requested should be authorized.

Lighter-than-air activities everywhere have been very much curtailed. With the commissioning of a tender which will permit the better employment of the kite balloon, greater interest in the use of these units is to be expected. At the present time operations with kite balloons in the fleet are attended with serious difficulties.

The war definitely determined the airship to be primarily a naval unit. The Allied navies found the non-rigid airship to be of value in the anti-submarine campaign in convoy and patrol operations. The Germans demonstrated the usefulness of the rigid as a naval scout, after abandoning this type for offensive overland operations.

The rigid airship in its present state of development has a wide cruising radius and an ability to stay in the air for long periods of time. Owing to the excellent visibility and weather conditions prevailing in the Pacific and West Indian areas rigids would be of tremendous value in event of war to a fleet operating in these theatres.

The small non-rigids requested will always be useful for coastal work in time of war and are valuable as training units for lighter-than-air personnel. After his course in non-rigids, the pilot should then be competent to begin his instruction in rigid airships. During the coming year we will have one rigid in operation and one under erection in this country. We cannot be expected exhaustively to study the usefulness of rigids for naval work with but two ships of this character, and it is to be hoped that the Congress will see fit to continue our development in this line.

The Department has a giant seaplane under construction. A small amount of money has already been expended on this project from that appropriated for experimental work. The construction of a great ship along the line proposed by the Department is directly in the road of progress and should be continued. A considerable sum is requested for construction of stations, and a considerable part of this sum is to be devoted to construction in the Philippines, at Dutch Flats, and on the Pacific Coast rigid station.

The disinclination to appropriate unduly for naval shore activities is thoroughly appreciated and unquestionably ideas on this line are entirely correct, but it is submitted in passing that aviation is a new branch which does not fit itself readily into any of the naval shore establishments and bases already in existence, and facilities permitting flying must be created before flying can be conducted. All naval operations of every kind must always be based upon the land. This is true for work with ships as well as aircraft, and consequently any money wisely spent in shore development is a permanent asset and cannot be wasted in so far as aviation is concerned.

In the estimates for maintenance of stations, effort has been made to cut, and figures have been based upon actual performances during the past year. The fund for experimental work is believed to be the minimum that should be supplied. The matter of anti-aircraft research and methods for withstanding aircraft attack has recently been investigated by a board in the Navy Department, and it is evident that a considerable sum must be devoted to this important work. The recommendations of this board were not received until after the estimates herein contained had been submitted, but it is believed that the amount requested by the board ($1,000,000) can be covered in the total of $35,000,000 recommended for aviation purposes during this year.

It will be noted that an increase of $125,000 is proposed for drafting, clerical, and technical service. All progressive experimental and design work in aviation has been very much retarded through the lack of trained and skilled technicists. This is particularly the case now that many of the reserve officers, formerly employed in technical capacities, have left

the service. Something must be done to enable the navy to retain adequate technical assistance in order to insure the development of aviation.—*Aerial Age Weekly*, Feb. 7, 1921.

ENGINEERING

ELECTRIC SHIP PROPULSION DISCUSSED.—The question of whether reduction gearing or electricity is better for ship propulsion was the principal subject of discussion at a joint meeting of the New York sections of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers, held on January 28. The chief features of interest in a lengthy program were an address by Admiral Benson, chairman of the United States Shipping Board, and two papers on ship propulsion by Eskil Berg, of the General Electric Co., and W. E. Thau, of the Westinghouse Electric & Manufacturing Co.

Admiral Benson pointed out the need of perfecting every possible device for making our merchant ships more efficient, in order that we may hold our present position in world trade and eventually make it stronger. He gave it as his opinion that the system of ship propulsion that will ultimately prove superior to all others for mercantile vessels as well as warships is the "Diesel-electric" type. He said he had the utmost confidence in the new merchant ship *Eclipse*, the electric propulsion machinery of which was described in *Power* for Nov. 2, 1920; that he had, in spite of criticism, sent this vessel on its first voyage all the way to the East Indies; and that the latest report, from Singapore, stated there had not been a bit of trouble since leaving port.

Mr. Berg, in his paper, "Turbine Reduction Gears *vs.* Electric Propulsion for Ships," said that the question depends entirely upon the type and operating conditions of the vessel concerned. He pointed out that the Navy Department has decided upon electric drive for all the larger vessels, but he described the geared turbine as being more advantageous in fast destroyers and light cruisers where the propeller speed is always high. In the case of mercantile ships he felt that each individual installation deserves study and that no general rule can be drawn except, possibly, that electricity is better for fast passenger liners.

In summing up, the speaker gave the following points in favor of electric drive.

It affords easy reversal at full power by electrical connections without reversing the turbine.

It makes it possible quickly to detect trouble and to check up on fuel consumption, by means of voltmeters, ammeters, and other accurate electrical instruments.

It is practically noiseless.

Electrification of mills and factories has greatly reduced maintenance cost and is expected to have the same result on ships.

It makes possible economical cruising at reduced speeds.

In case several generating units are used, one may be shut down without impairing the efficiency of the complete installation.

As the turbine is never reversed and there are no reverse blades dragging, a higher degree of superheat and higher steam pressure may safely be used.

The omission of reversing blades shortens and lightens the turbine shaft and thus permits higher speeds and longer bearing life.

The generating units may be put in any convenient place, near the boilers, for instance, and the motor at the extreme stern if desired, thus eliminating the space requirements and bearing troubles of a long propeller shaft.

Arrangements may be made to drive the main auxiliaries by electricity, so that if the main generating unit breaks down, steerageway may be maintained by the auxiliary unit.

Comparing the efficiency of electric drive with that of gear drive, Mr. Berg declared that there is little difference in fairly large installations, such as 3000 horsepower and over. He gave about 92 to 94 per cent as representative efficiencies of the transmission apparatus, consisting of gear in one case and a generator and motor in the other. He put the cost of electric drive slightly higher than for gear drive.

W. E. Thau, in his paper, "Electric Propulsion of Ships," agreed with Mr. Berg that the type of drive depends upon a number of different factors, so that no system of propulsion can well be recommended for general use. He regarded electric drive as a logical and successful development, but declared that the geared turbine drive has come to stay and has a legitimate field. He described the internal-combustion or Diesel drive as offering possibilities superior to those of any other type. Mr. Thau said, however, that the development of high-speed Diesel units for electric drive has not been perfected in sizes that will permit a drive in excess of approximately 6000 horsepower. He advocated the use of a number of small, high-speed Diesel engines so as to obtain greater flexibility and reserve power.

In the discussion that followed the papers, G. A. Pierce, of the William Cramp & Sons Ship & Engine Building Co., defended strongly the use of turbine reduction gears and criticized electric drive, particularly for its complexity and the difficulty of training men to handle it at sea. He even questioned the superiority of electric drive at cruising speeds over a well-designed turbine installation containing geared cruising turbines. He asserted that the full-power reversing made possible by electric drive is unimportant, because no more than about one-third of full power can properly be utilized in stopping a ship and no more than that is needed in backing. He then read a statement from J. F. Metten, chief engineer of the Cramp Company, which said that proponents of electric drive generally compare the newest and best examples of that system with selected failures of gear drives, and that in his opinion the latter type will eventually prove its superiority.

Commander C. A. Jones, of the U. S. Navy, on the other hand, said that as far as capital ships in the navy are concerned, electric drive has come to stay, and also that no great difficulty has been encountered in training the engineer force to handle the electrical machinery involved.—*Power*, Feb. 8, 1921.

PROBLEMS AWAITING SOLUTION IN DIESEL-ENGINE DESIGN.—Problems and Probable Field of the Oil Engine, Paul Rieppel. The author starts with the discussion of the economical and political problems connected with the control of the world's supplies of oil and of the application of the oil engine—by which he means the various types of internal-combustion engines, the Diesel and its modifications being first considered. In the course of the article the author makes many interesting observations and raises several questions well worth attention.

Combustion Processes.—As regards the nature of combustion processes in the Diesel engine, our knowledge has reached the point where we can clearly distinguish the processes of injection, vaporization, gas formation and combustion. The author believes, however, that a very wide field in this domain remains as yet unexplored and that more work should be done in the laboratory by the physicist, such work being preferable in many cases to extensive experimentation on actual engines.

The most rapid and complete combustion is a function of the fineness of atomization, intermixture with air, and, to an extent which has not yet been fully appreciated, of turbulence. No thorough tests have been made to determine what is the best method to obtain the most complete atomization and what fineness of atomization is needed under each set of conditions.

As to the influence of catalysis in the cylinder, whether that due to presence of water or of some other catalytically acting material, the tests

of Stein contain valuable material, but the influence of very small, in fact extremely small, amounts of water on fuel combustion remains as yet to be investigated. As a matter of fact we know that under certain conditions very poor oils burn better in the presence of water, and the use of other catalytic agents, such as silicon and various metals, may bring startling developments in engine design and offer a means of increasing our ability to control combustion.

How to obtain the best possible conditions of turbulence and how to evaluate the influence of turbulence are questions which may be answered by tests on self-ignition of oils and the velocity of flame propagation therein. In a bomb, oil vapor at rest does not ignite at all at temperatures corresponding to the temperature of compression in a Diesel engine, but when a slight turbulence is produced, as for example, by injecting a small amount of air, self-ignition takes place. This and other questions must be considered by everyone interested in the subject of combustion processes, and they are not mere academic problems but important stones in the foundation upon which the structure of economic design of an engine has to be raised. Had we had this information a highly economic Diesel engine could have been designed long ago and have done away with the compressor. From this the author proceeds to the discussion of various attempts to build a Diesel engine without a compressor, such as have been proposed by Vickers, Price and Steinbecker.

Economy of Operation.—In the determination of the economy of operation, questions as to the use of a 4-stroke or 2-stroke cycle, high or medium pressures, are ones which lie at the foundation of the problem. After discussing briefly the relative position of the 4- and 2-stroke cycles and the question of scavenging, the author proceeds to the question of compression and asks whether we shall continue to operate Diesel engines with a combustion of 35 atoms, and the heavy weight of the engine and mechanical difficulties which it involves.

The higher thermal efficiency secured with this compression does not have decisive value in the author's eyes, as motors employing lower compression pressures would have a lower first cost, be more reliable and show a better mechanical efficiency. As regards the advantage secured through self-ignition of the mixture, it is pointed out that the point of self-ignition is lowered very materially when the cooling produced by the expanding stream of the injection air is eliminated. With solid injection every condition of engine operation can be met without external means of ignition at a pressure of 25 atoms. But even assuming that self-ignition would have to be dispensed with, why not? The high value placed on the ability of the engine to operate on a basis of self-ignition is a survival of a time when electrical ignition was still complicated and unreliable. To-day it is quite easy to provide reliable means of producing a good electric spark having a good control of timing, or, where necessary, to produce a wire spirally wound and maintained constantly at a glowing heat by a flow of electric current. There is no reason why one should not employ outside methods of ignition in engines in which the most economical operation may be secured at compressions at which self-ignition can no longer be relied upon.

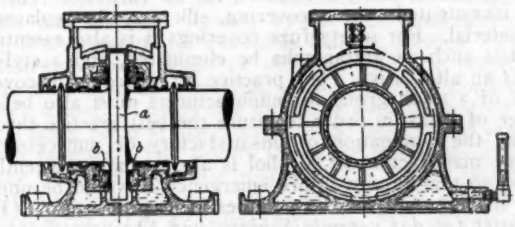
In connection with the problem of securing the most economical operation of oil engines, the author takes up the question of utilization of waste heat. It is true that as high as 40 per cent of the heat in the fuel may be usefully employed in the oil engine, but this is no reason why one should waste the other 60 per cent without any effort at recovery. The comparison with the 12 per cent heat efficiency of the steam engine is often misleading because in a steam engine a good deal of the heat in the exhaust steam may be still utilized for purposes of heating and drying. In properly conducted factory processes employing steam, the power generated by the steam engine should be considered as a mere by-product, while in the case of oil-engine drive it is the main if not the only product of fuel combustion.

The problem of utilizing the waste heat of oil engines is one of the most important from an economical point of view. The usual way is to pass the exhaust gases on to steam boilers, a method well known in large gas-engine operation. This cannot be done as conveniently with oil engines, because the temperature of the exhaust gases is considerably lower. Furthermore, any attempt at a thorough utilization of exhaust heat from oil engines would involve a considerable increase in the first cost of the installation and also possibly corrosion troubles due to the presence of sulphurous acid in the exhaust gases. In particular, in the case of auxiliary boilers on shipboard, it has been found advisable to equip them with direct oil heating in addition to heating by exhaust gases. An important physical problem is the determination of the coefficient of heat transfer from exhaust gases to the boiler wall. This is a question proposed by Nusselt, but, in general, the coefficients now employed are more or less of a rough nature and do not take into consideration many important factors.

In this connection may be mentioned attempts to mix the exhaust gases with steam and to add to them compressed air and utilize the mixture either in turbines or in reciprocating engines. It does not appear that any such efforts may lead to useful conclusions.—*Mechanical Engineering*, March, 1921.

KRUPP'S SINGLE COLLAR THRUST BEARINGS.—This new type of bearing is a modification of the well-known Michell thrust block. It is made in two types: oil bath and pressure feed.

In the case of the oil bath type the single thrust collar dips into the sump and, rotating, carries the oil along its circumference. This oil is



collected by a scraper at the top end of the bearing, and flows along troughs in this scraper to the ducts feeding the journal bearings of the thrust shaft. The troughs in the scraper are so arranged as to work for both directions of rotation. The oil level in the bath is kept below the bottom part of the shaft, an oil indicator being provided for the purpose. At the outer ends of the two journal bearings oil thrower rings are provided on the shaft, which throw the oil creeping past the bearing back into the sump. To prevent any oil leakage past the bearing cover, ordinary ring glands are provided. The oil caught by the sides of the thrust collar lubricates the thrust blocks or pads, which in the main follow the Michell design, *i. e.*, provide a wedge clearance, allowing a much higher initial pressure to be maintained without breaking the oil film. These blocks are white-metal lined, and their entering edge is rounded off to allow a better access of oil. In the Krupp design of these pads the special cage to hold them, as in the Michel type, is done away with, the blocks being kept in position in a ring groove of the bearing body by means of hook-shaped lugs. The length of these lugs is about two-thirds of the length of the pad; this allows a certain amount of rolling of the latter to give the necessary wedge-shaped clearance. The propeller thrust is transferred through those pads to the bearing body and to the ship's hull. A number of these thrust

bearings were supplied to the German submarines. The pressure type consists of one journal bearing and two thrust collars, the oil being fed to the center groove in the bearing and then leaks past it to the thrust collars, which carry it away to lubricate the pads contained at both ends of the journal bearing. In this case only one side of the thrust collar rests against pads, and one collar working at a time.—*The Technical Review*, Feb. 15, 1921.

ORDNANCE

MILITARY INITIANTS AND THE INDUSTRIES OF PEACE.—The conclusion of an article on the utilisation of military initiants for peaceful purposes. The disposal of certain surplus detonators, caps, and safety fuze is dealt with, and conclusions drawn as to the developments necessary in the industry as a result of war experience.

It is emphasized that every endeavor should be made to restrict the varieties of detonators and caps manufactured, such varieties as are kept being made useful for as many purposes as possible, both for industrial and military use. Production should in all cases be possible with existing machinery, and the design should be as simple as possible, thus facilitating increase of production when necessary. Detonator shells should never require more than five pressings, and all with threads, flanges, etc., should be eliminated. Aluminum should be universally adopted for their manufacture. This is undoubtedly the future material for the purpose, and Germany's war experience in its use should enable her to get in front of foreign competitors and re-establish her overseas trade in the commodity. Fulminate of mercury in detonators must be replaced as rapidly as possible, tetryl and trinitrotoluene with a small quantity of lead azide being introduced for all varieties. The latter must be further investigated. As a covering, silk must be replaced by home-produced material. For safety fuze coverings it is also essential that foreign materials such as guttapercha be eliminated, and acetyl-cellulose is suggested as an alternative. The practice of regarding discoveries as the trade secret of a small group of manufacturers must also be replaced by the exchange of ideas, in order to insure the best practice throughout the industry, and the elimination of unsatisfactory or unnecessary varieties. The synthetic manufacture of alcohol is also a matter urgently requiring investigation, so that in any future emergency it would be unnecessary to utilize such an important food as potatoes in its production. (Paul Galewsky, *Zeitschrift für das gesamte Schiess- und Sprengstoffwesen*. Nov. 1, 1920.)—*The Technical Review*, Feb. 15, 1921.

MERCURIC AZIDE.—An account of the preparation and some of the properties of a fulminating agent of great violence, and, under certain conditions, extreme sensitivity. The preparation was undertaken as part of a research to discover a highly sensitive initiant, but this feature is so highly developed in mercuric azide that the substance is incapable of being put to practical use. Its preparation is described as one of the most dangerous and treacherous operations known to chemistry.

The mercuric azide was prepared by placing 6.5 gm. of sodium azide in a small flask and adding concentrated sulphuric acid drop by drop, the evolved hydrazoic acid being led to the bottom of a container in which had previously been placed 10 gm. of mercuric oxide and 200 gm. of boiling water. The oxide quickly disappears, and a nearly concentrated solution of mercuric azide is formed. The excess mercuric oxide is quickly separated by filtering through a hot water jacketed funnel, the solution being caught in a number of beakers and stirred continuously with a wooden rod to prevent the formation of large crystals. Rapid radiation from the beaker walls must be prevented, as otherwise clots of crystals form thereon, when an explosion is certain. If the solution is not agitated, long acicular crystals form, and these explode as soon as movement

occurs, the whole mass detonating even when under water. The crystals are white and transparent at first, but turn bright yellow on exposure to light. If crystallized under agitation, the product is a crystalline powder, and has a similar sensitivity to impact to fulminate of mercury. Crystals over 1 mm. in size are, however, extremely dangerous. It is recorded that a small clot of crystals which formed in the funnel stem and were removed by washing with water, sank through a considerable depth of water in the beaker, and on touching the bottom detonated violently, completely destroying the apparatus, making a hole of about 2 cm.. diameter through the wooden bench, and projecting glass particles no larger than dust clean through thick-walled glass apparatus in the vicinity. An alternative method of preparation is to mix cold concentrated solutions of sodium azide and mercuric nitrate, when the mercuric azide is formed as a cheese-like precipitate. In this extremely fine state of division the substance appears to be somewhat less sensitive than lead azide. Mercuric azide is of the same molecular weight, and on explosion releases the same amount of gas as fulminate of mercury, but the former is more brisant than any other of the known azides, and is capable of causing the complete detonation of high explosives when quantities are used of only one-twentieth to one-thirtieth of the weight of the fulminate of mercury which is necessary. While the detonation of the fulminate is accompanied by a dull, reddish, indefinite flame, that of the azide is a remarkable bright blue flash of almost magical tint. (Alfred Stettbacher, *Zeitschrift für das gesamte Schiess- und Sprengstoffwesen.*)—*The Technical Review*, Feb. 15, 1921.

SHORE BATTERIES ATTACK U. S. S. "MASSACHUSETTS."—Highly successful firing tests were made in January by our Coast Artillery against the old battleship *Massachusetts* off Pensacola Harbor, Florida. They proved that more destructive results can be obtained by firing projectiles from guns, mortars and howitzers at high angles than by horizontal attack against the belt armor. Twenty-five hits were obtained out of 85 rounds, the high angle firing being at distances of from 5000 to 6000 yards, carried out by 12-inch mortars. The results showed that railway artillery is as accurate as the fixed gun, and this in spite of the greater length of range. A number of hits were obtained by 12-inch railway guns at the great range of 20,000 yards.—*The Scientific American*, Feb. 26, 1921.

MISCELLANEOUS

REASONS FOR AMERICAN UNPOPULARITY ABROAD.—Men who go abroad in the interests of foreign trade are oftentimes surprised to find that this country is unpopular among foreigners to whom we desire to sell our goods. On their return these travelers are occasionally interviewed by reporters, whose stories appear in the newspapers under such headings as "Says Argentinos Dislike Us," "Brazilians Offended, Threaten Reprisals," or "Europeans Affronted by Treatment Here." If we endeavor to trace the cause of this ill-will we usually find that it has its origin in the actions of our lawmakers and officials. While, in fact, our commercial representatives are striving to extend our foreign trade our legislators and department heads are doing everything possible to destroy their work. Good will is the essence of successful trading, a fact that is apparently forgotten by those who seek to abrogate our commercial treaties with foreign countries, to establish discriminatory duties against foreign shipping and raise a tariff wall that would shut out numerous imports from nations with which we expect to trade. In addition to all this, foreigners are constantly irritated by the enforcement of annoying and frequently unnecessary rules and regulations which, in some cases are likely to provoke retaliation.

A good example of this sort of officialism is the recently announced ruling that foreign ships are not to be allowed to enter United States ports with alcoholic liquor on board, regardless of whether it is sealed or in transit from one country to another. This attempt to force our dry laws on foreigners, even if the ruling remains a dead letter, is none the less intolerable. It has already been severely condemned in all parts of the world. Quite apart from any moral factor entering into the drink question, this interference with the liberties of other people is bad business, and it is not likely to increase our popularity abroad. In any event there can be no doubt that any effort to enforce the ruling would precipitate strong opposition in which the principal maritime nations overseas would be firmly united.—*The Nautical Gazette,* Feb. 2, 1921.

WORLD'S TRADE REVIVAL HINGES ON REVISION OF PEACE TREATIES.—Shipping men are realizing more and more that no permanent improvement in ocean transportation rates can take place until the countries of the world begin to interchange goods on something like the pre-war scale. Experts are agreed that the principal cause of the present widespread economic crisis is the inability of the nations of Central and Eastern Europe, which formerly absorbed one-third of the world's output of raw materials, to purchase their usual quota of products. For this state of affairs the unwise economic clauses inserted in the Paris peace treaties are largely responsible. These treaties have been drawn on the theory that the way for the victors in the war to obtain economic supremacy was by putting fetters on the trade and diminishing the resources of the enemy states. The fact was overlooked that no nation can be plunged into adversity without its neighbors being similarly affected.

How true this assertion concerning the commercial interdependency of nations is appears from the figures of Hamburg's ocean traffic during recent years appearing on another page. One reason for the existing depression in British shipping is that British vessels of only 952,000 net tons had occasion to call at Hamburg last year, while the British merchant fleet putting in at the same port in 1913 aggregated 4,096,000 tons. The two-thirds shrinkage recorded in Hamburg's overseas trade between 1913 and 1920 has therefore diminished considerably the opportunities for the profitable employment of British shipping, which could not fail to gain were Germany's trade to revive. Instead of recognizing this truth, however, the Allies insisted upon the surrender of all of Germany's ocean-going fleet, thereby correspondingly retarding the ex-enemy country's economic rehabilitation. The tonnage thus parted with the Germans could have used to good advantage, while the Allies are experiencing difficulty in keeping it employed. Of the 301 German vessels allocated to Great Britain, only about half had been sold according to last accounts. Many of those undisposed of are tied up in British harbors doing no good to anybody, while those recently marketed have been sold at such low prices that the British exchequer has been but slightly benefited.

If the Allied statesmen could only be made to realize that in helping Central Europe to its feet they would be removing one cause of unemployment in their own countries, the return of normal trade conditions could be greatly hastened by undoing the mistakes of the peace treaties. But unless they are willing to pursue such an enlightened policy it is certain that the economic restoration of Europe will be long delayed to the detriment and mutual loss of all the great trading nations and with the resultant continued prostration of the world's shipping.—*The Nautical Gazette,* Feb. 26, 1921.

CONCRETE SHIPBUILDING IS STILL IN EARLY EXPERIMENTAL STAGES.—In a communication to the *Nautical Magazine,* attention is called to the fact that, whereas shipbuilding in wood and steel has practically reached its

finality, the use of concrete for this purpose is still in its infancy. Improvements are constantly being made in the direction of lighter and stronger mixtures together with the more effective disposal of the steel reinforcement and concrete.

By using a coke aggregate for instance, where the material is mixed with Portland cement to form concrete, the weight per cubic foot has been reduced from 160 to 110 pounds and even further improvements in this direction may be expected. Already ships can be built of concrete which weigh less than wooden vessels of equal cargo-carrying capacity, and in time the weight of concrete hulls may even approach that of those built of steel.

In addition to being lighter, concrete has other advantages over wood for shipbuilding, being cheaper and more durable, while costing much less for repairs and upkeep. The position is fully appreciated in Norway where a very successful concrete shipyard has been in operation for several years in spite of the plentiful supplies of timber procurable in that country at comparatively low prices. At this establishment a concrete motor ship of 1000 tons was lately completed. In Denmark also concrete shipbuilding is being carried on, two vessels of 1300 tons having been recently built there.

In England one of the most enterprising of British concrete shipbuilding concerns is Concrete Seacraft, Ltd., on the Mersey, which employs the Ritchie unit system of construction. According to this method 75 per cent of the hull is made up from small units which are cast separately, to be assembled and set up at the building berth. Each unit consists of a section of the shell between the frames, in fact, flanges at the ends form the latter.

With transverse frames joints are arranged at the bilges and keelson, so that such frame is in four parts. Longitudinal members are continuous, holes or notches being provided for them in the transverse units. Naturally they are cast after the latter have been placed in position. Cross diagonal bracing bars which pass through notches in the frames are arranged over the entire hull. Finally the spaces between the frame flanges are grouted with cement.

Either the transverse or longitudinal method of building may be employed with the Ritchie system. It has the further advantage of facilitating the inspection of every part. Owing to this feature, Lloyd's and other classification societies are willing to allow a great reduction of thickness as against the casting of the complete ship on the building site. By the Ritchie method a thickness between frames of 1¾ inches is considered enough for vessels of 250 tons, while only 2½ inches are demanded for those with deadweight capacities of 1000 tons. In the former case a thickness of 3½ inches is insisted upon with the older form of construction

One notable benefit accruing to the use of concrete for shipbuilding is its anti-fouling properties. It is not suggested that no fouling takes place, but the growths are very much lower and more easily removed than is the case with steel and wooden hulls. It is also quite possible that by rendering the underwater bodies with neat cement to a smooth surface even better results may be achieved.

The outstanding advantages of concrete, however, is the low cost of upkeep. So far as is known at present ships built of concrete are almost everlasting. Naturally, rails, bulwarks, and other exposed parts will be occasionally chipped and damaged, but these can be made good as when new by a builder at an almost trifling cost. Not long since the 5000-ton American concrete steamer *Faith* had a hole knocked in her side owing to a collision with another vessel, but the damage is said to have been made good by a bricklayer and his mate for £5.

Officers and engineers who have sailed the seas in concrete ships state that the behavior of these crafts is excellent when seas are running. All

agree that there is a notable absence of vibration, while it is generally admitted that concrete ships are more easily driven than those of wood and steel having a like displacement. In other words, the speed is higher for a given horsepower and tonnage.—*The Nautical Gazette*, March 5, 1921.

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NOTES ON INTERNATIONAL AFFAIRS

FROM FEBRUARY 10 TO MARCH 10

PREPARED BY

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LONDON CONFERENCE ENDS IN FAILURE

In accordance with previous plans, Allied representatives met those of Germany in London during the first week of March for the purpose of presenting to Germany the reparation terms as finally decided upon by the Allies. The Allied representatives, as it developed later, were ready to consider changes in the method of payment, and in details, but were in no mood to accept such radical reductions as Germany submitted by way of counter-proposals.

The Allied terms called for payment of about 226 billion gold marks, spread over a period of 42 years, and a 12% tax on German exports. In his initial reply on March 1, the German Foreign Minister, Dr. Simons, proposed that the total sum be reduced at once to 50 billion marks, that about 20 million be subtracted from this for reparations already made, and that on the remaining 30 million marks (about 7½ billion dollars) Germany pay 1 billion marks a year until 1926, when the whole question would come up for readjustment. In immediate reply Premier Lloyd George declared: "The German Government appears to have a complete misunderstanding of the realities of the situation, and the Allies have already agreed that the German proposal is one they cannot examine or discuss." On the following day he insisted that Germany must continue to accept responsibility for the war, that she had already been guilty of violations of the treaty, and that her people were not as heavily taxed as those of Allied nations. The Germans were given four days in which to accept the Allied terms or present an offer worthy of consideration.

FINAL REJECTION OF GERMAN COUNTER PROPOSALS.—On Monday, March 7, Minister Simons presented a modified proposal, which was indeed more nearly that which he had been authorized to make by his government. In brief, he agreed to pay the annuities demanded by the Allies (two billion marks) for a period of five years. Even this, however, was contingent upon Germany's retention of Upper Silesia in the approaching plebiscite, so that, as the British Premier said, it was an offer for five weeks and not for five years. As to what would be done at the end of the five years no assurance was given. The offer was therefore rejected as wholly unsatisfactory.

ENFORCEMENT OF PENALTIES.—Immediately upon the conclusion of the London Conference the Allied powers proceeded to execute the penalties which had been agreed upon in the event of German refusal. These consisted of occupation of Duisburg, Ruhrort, and Duesseldorf, ports for the Ruhr region on the east bank of the Rhine; a tax not to exceed 50% on the sale price of German goods in Allied countries; and establishment of a customs line along the Rhine. It was explained that, in the application of the 50% tax, a purchaser of German goods in Allied countries would pay half the purchase price to his own government, which would give him a certificate to be turned over by him to the German merchant, who would get the certificate redeemed by the German Government in German money. On March 7 the Allied forces, consisting chiefly of about 10,000 French and 5000 Belgians, were in movement and had completed the occupation of the Rhine ports on the following day.

The Germans offered no resistance, but declared they would protest to the League of Nations on the ground that no penalties should have been inflicted until May 1, the date set by the Versailles Treaty as the limit for agreement on reparations. The Treaty read, however, that the terms must be presented *on or before* that date. Furthermore, the Allies based their action on violations by Germany of other treaty terms. Upon the execution of the penalties, Germany as a protest recalled her envoys from London, Paris, and Rome.

READJUSTMENT IN NEAR EAST

REVISION OF TURKISH TREATY.—Prior to the Reparations Conference, delegates from Turkey and Greece were requested to meet in London to consider a revision of the Treaty of Sevres. In preparation for the conference, former Premier Venizelos of Greece worked in cooperation with the representative of King Constantine's government, Premier Kalogeropoulos, aiming to retain the acquisitions granted to Greece by the treaty. Both the Constantinople government of Turkey and the Turkish Nationalists sent delegates, the two factions working with perhaps more coordination than appeared on the surface.

The meetings, which began on February 21, were devoted chiefly to hearing the Greek and Turkish claims. No general action was taken aside from a decision that an investigation be made of conditions in Smyrna and Thrace prior to alteration of the treaty.

The French Government, which was favorable to the Turkish Nationalists and responsible for their inclusion at the conference, reached terms for a treaty of peace with that faction. The treaty provides for French evacuation of Cilicia in eastern Asia Minor, on condition of Turkish acceptance of the proposals made in London for protection of minorities in regions under Nationalist control.

PERSIAN CABINET UPSET.—A force of 2500 Persian Nationalist Cossacks on February 22 entered the Persian capital, Teheran, and compelled the resignation of Premier Sephandar Pasha. It is not known whether British

influence was in any way connected with the coup, both the Premier and the Nationalists being supposedly opposed to British domination of Persian politics.

BRITISH RAIL ROUTE TO INDIA.—Washington, Feb. 20 (*Associated Press*).—The complete text of the Franco-British convention of December 23, 1920, by which the Syrian Desert is transferred from a French to a British mandate was received here to-day, and is expected to engage the close attention of officials of the State Department.

The two phases of the treaty which have engaged particular attention are the establishment of the precedent of a transfer of mandate territory from one power to another without reference to the League of Nations, and the acquisition by Great Britain of her dream of an all-rail route from the Mediterranean to India.

The southern portion of Syria, bordering upon Palestine, previously allotted to France by the League of Nations, is transferred to Great Britain, and specific provision is made for the construction of a British railway line linking Palestine with the Mesopotamian railway systems through the Syrian Desert.

Part of the British all-rail route from India to the Mediterranean, according to advices received in official circles recently, was begun secretly during the war and has been completed from Quetta, in Northern India, to a point in Central Persia, skirting the Afghanistan border. The rail route from Palestine would cross the Syrian Desert and, passing through Basra, in Southern Mesopotamia, would effect a junction with the line already completed from India at a point in Southern Persia. With the transfer of Southern Syria from France to Great Britain, according to officials, only the Southern Persian link would be left outside the political control of Great Britain, and even this link is now partly under her political and wholly under her military control.—*N. Y. Times,* Feb. 21, 1920.

LEAGUE OF NATIONS AND MANDATES

LEAGUE COUNCIL MEETING IN PARIS.—The League Council meeting in Paris on February 21 was devoted largely to routine matters. After lengthy discussion with representatives of Poland and Lithuania, it was decided that the plebiscite for the Vilna district and the sending of an international force thither should be abandoned, owing to failure of both nations to refrain from military activities in the disputed area. The territorial dispute will again be taken up in direct negotiations at Brussels, presided over by M. Paul Huymans as representative of the League.

A committee was appointed to consider amendments to the League Covenant and report at the Assembly meeting in September. Proposed changes include the Canadian amendment eliminating Article X and the Argentine proposal for immediate admission of all nations.

AMERICAN PROTEST OVER MANDATES.—At the Council session on February 22, the U. S. Ambassador to France presented a note from Secretary Colby insisting upon the right of the United States to a voice in all discussions and decisions as to the terms on which mandates should be granted. The note reaffirmed the principles set forth in the note to the British Foreign Office last November. It insisted on equality of economic opportunity and the "open door" in mandate territories for all nations whether or not members of the League of Nations. It called attention to

apparent violations of this principle in the British mandate over Mesopotamia, and cited the reservations made by President Wilson regarding the Japanese mandate over the island of Yap.

COUNCIL REPLY CONCILIATORY.—In reply to the American note, the Council stated that the allocation of Yap to Japan was made not by the League Council but by the Supreme Council of the Allied Powers in May, 1919, and the misunderstanding should therefore be taken up with the nations represented in that body. The Council, however, had in its session of December 17, 1920, approved the form of Class C mandates covering former German possessions in the Pacific.

Regarding Class A mandates, including Mesopotamia and other former possessions of Turkey, action on the part of the Council was postponed until May or June. The Council invited the United States to send a representative to take part in its discussions at that time.

BRITISH POSITION UNYIELDING.—Washington, March 5.—The British Foreign Office's reply to the Colby note on mandates, in which the American demand for equal opportunity for United States nationals in the economic employment of Mesopotamia was advanced, is conciliatory in tone, but rejects the American contentions in respect of Mesopotamia.

The British Government, while in the main agreeing with the Colby definition of the principles controlling mandates, subscribes reservations, but in the instance of Mesopotamia flatly declares that it will not "discriminate" against its own nationals, maintaining that Britishers obtained monopolistic rights in Mesopotamia before mandates were conceived, and even before the outbreak of the war.

As the question of mandates is one of the keystones to the entire American position regarding the rights of this country flowing out of the victory over the Central Empires, it is understood that Secretary of State Hughes, before beginning the draft of a reply to the British note, will review the whole subject, from the inception of mandates at Paris to the acts of the American plenipotentiaries and government both during and after the Peace Conference.

It is felt here the Mesopotamia issue is not in precisely the same category as the Island of Yap, as the British Government now maintains that the exclusive rights it asserts in Mesopotamia were not acquired as a result of the war, but antedated the war and bear no proper relation to the mandate. The determination of the Yap issue, it is said, depends upon Mr. Hughes's findings, after examination, in respect of the reservations filed by President Wilson at Paris.

The Senate Foreign Relations Committee is known to have accepted the validity of the reservations, and it is said to insist upon their effectiveness, and there appears to be little doubt that the new Administration tends to maintain the same position as that defined by the Wilson Administration on the subject of Yap. The continuance of Under Secretary of State Davis, although only temporarily, as a delegate to the Communications Conference, is accepted generally not only as a compliment to Mr. Davis, in appreciation of his work on that body, but as an indication of the likely attitude of Mr. Hughes toward the Yap and cables problems.—*N. Y. Times*, March 6, 1920.

JAPAN WILL INSIST ON RETENTION OF YAP.—Regarding the attitude of Japan on control of the island of Yap, Count Ishii, Japanese Ambassador to France, expressed the opinion that his government would be willing to "compromise" on some such basis as a guarantee of free use of the island for cable purposes without surrender of Japanese control.

Foreign Minister Uchida, speaking in the Japanese Diet on March 7, pointed out that notes on the subject had been exchanged last year between the United States and Japan. When the mandates were considered, he continued, President Wilson protested, but when the final decision was reached America made no reservations. He added that he considered the question of the Yap mandate definitely decided. As for the question of the concession of Pacific cables to the United States, he said he was unable to speak on it.

MANDATES AND OPEN DOOR.—Mandates have been divided into three groups, Class A including former Turkish possessions, Class B former German possessions in Central Africa, and Class C German possessions in Southwest Africa and the Pacific. A statement issued by the News Bureau of the League of Nations Association points out that the Class B mandates guarantee economic equality only to league members.

The open door restrictions are considered by the News Bureau as having a direct bearing upon the United States as a non-member of the League. The article regarding the open door says:

"The mandatory will insure to all nationals of states, members of the League of Nations, on the same footing as his own nationals, freedom of transit and navigation, and complete economic commercial and industrial equality; provided that the mandatory shall be free to organize essential public works and services on such terms and conditions as he thinks just.

"Concessions for the development of the natural resources of the territory shall be granted by the mandatory without distinction on grounds of nationality between the nationals of all states members of the League of Nations, but on such conditions as will maintain intact the authority of the local government."

However, the British mandate over Palestine, the full text of which appeared in the *N. Y. Times* of February 28, made no such distinction between nations within and outside the league.

ARGENTINA REFUSES TO BAR GERMAN MUNITIONS.—According to news despatches of February 18, the Argentine Government had refused the request of the Allied Powers that it bar German exportation of war materials to Argentina in contravention of the Treaty of Versailles. Argentina took the ground that German violations were not the concern of a nation not a party to the treaty. The Allied Powers can, however, check German exports by means of their control commissions in Germany.

GREAT BRITAIN

MILNER REPORT URGES FREE EGYPT.—The report of Lord Milner, former British Colonial Secretary, on the Egyptian question was presented to Parliament on February 18. It urged that negotiations should be started as soon as possible for the conclusion of a treaty according self-government to Egypt, with her own foreign representatives, but without complete withdrawal of British supervision. The document, which is dated December 29, 1920, includes a memorandum agreed upon in negotiations with Egyptian representatives as a basis for the proposed treaty.

THE IRISH PROBLEM.—During the month ending March 10 there was little apparent change in the Irish situation. Premier Lloyd George on February 15 declared that conditions were "definitely and decidedly improving," that boycotting was at an end, that Irish recruits were again joining the constabulary, and that the Crown police and courts were recovering authority. He stated that one company of the constabulary, according to the unpublished Strickland report, were involved in the Cork burnings and would be punished.

On February 16 President Eammon de Valera of the Sinn Feiners sent a protest to members of the British Parliament against seizure of firearms, use of hostages, torture of prisoners, and other methods employed by British forces "contrary to all rules of civilized warfare." The Irish Republic on March 7 issued a manifesto to foreign nations reciting the grievances of Ireland and claiming their desire for "peace on a just basis."

The Mayor of Limerick, George Clancy, the ex-mayor, and another citizen were murdered in their homes on the evening of March 6. It was claimed that the murders were in reprisal for the assassination of the British Brigadier General Cumming on March 4.

SPAIN

PREMIER ASSASSINATED.—Premier Eduardo Dato of Spain was assassinated on the evening of March 8 in Madrid while returning from the Chamber in a motor car. He was attacked by several persons, who fired a number of shots.

Dato was leader of a group of the Conservative party and has headed the government for a large part of the time during and since the war. Last October he announced a program of sweeping industrial reforms, combined with strong measures for suppressing internal disorders. Dato resigned in January, but was persuaded to remain in office.

RUSSIA

POLES SECURE AID AGAINST SOVIET.—The Franco-Polish Agreement recently negotiated by Marshal Pilsudski is said to assure French expert military advice, munitions, and supplies, but no French troops, in the event of an attack on Poland by Russia. It is also reported that a defensive alliance against the Soviets has been entered into by Poland, Bulgaria, and Hungary.

PETROGRAD IN REVOLT.—Anti-Red uprisings in Russia and especially in the Petrograd district, beginning in the latter part of February, increased in scope until on March 9 it was reported that the revolutionary forces, controlling eight ships of the Baltic fleet and the Kronstadt fortress, had silenced the minor forts of Petrograd and were preparing to enter the city. Later despatches indicated that the revolt had been checked.

UNITED STATES

INAUGURAL STATEMENT ON FOREIGN POLICY.—The following passages of President Harding's inaugural address were studied with interest as clues to the new administration's foreign policy:

"The recorded progress of our Republic, materially and spiritually, in itself proves the wisdom of the inherited policy of non-involvement in Old World affairs. Confident of our ability to work out our own destiny and jealously guarding our right to do so, we seek no part in directing the destinies of the Old World. *We do not mean to be entangled. We will accept no responsibility except as our own conscience and judgment in each instance may determine.*

"Our eyes never will be blind to a developing menace, our ears never deaf to the call of civilization. We recognize the new order in the world with the closer contacts which progress has wrought. We sense the call of the human heart for fellowship, fraternity and co-operation. We crave friendship and harbor no hate. But America, our America, the America builded on the foundation laid by the inspired fathers, *can be a party to no permanent military alliance. It can enter into no political commitments, nor assume any economic obligations or subject our decisions to any other than our own authority.*

"I am sure our own people will not misunderstand nor will the world misconstrue. We have no thought to impede the paths to closer friendship. We wish to promote understanding. We want to do our part in making offensive warfare so hateful that governments and peoples who resort to it must prove the righteousness of their cause or stand as outlaws before the bar of civilization.

"We are ready to associate ourselves with the nations of the world, great and small, for conference, for counsel, to seek the expressed views of world opinion, to recommend a way to approximate disarmament and relieve the crushing burdens of military and naval establishments. We elect to participate in suggesting plans for mediation, conciliation and arbitration, and would gladly join in that expressed conscience of progress which seeks to clarify and write the laws of international relationship, and establish a world court for the disposition of such justiciable questions as nations are agreed to submit thereto.

"In expressing aspirations, in seeking practical plans, in translating humanity's new concept of righteousness, justice and its hatred of war into recommended action we are ready most heartily to unite, *but every commitment must be made in the exercise of our national sovereignty.*

"Since freedom impelled and independence inspired and nationality exalted, a world super-government is contrary to everything we cherish and can have no sanction by our Republic. This is not selfishness, it is sanctity. It is not aloofness, it is security. It is not suspicion of others, it is patriotic adherence to the things which made us what we are."

SENATE VOTES FOR ARMS CONFERENCE.—By a unanimous vote the Senate on March 1 attached to the Naval Appropriations Bill the Borah resolution calling upon the President to invite a conference of the United States, Great Britain, and Japan to consider naval reductions. This action followed a lively seven-hour debate on the navy and foreign problems. Action on the bill itself was postponed until the next session of Congress through the opposition of a minority led by Senator Borah.

VIVIANI TO COME AS FRENCH ENVOY.—In March the French Government is to send Réné Viviani to the United States for about two weeks to present the views of France to the new administration and present argu-

ments in support of the Versailles Treaty and against a separate peace with Berlin.

NOT PLEDGED AS TO ALLIED DEBTS.—In a conference with Mr. Harding on February 15, Mr. Thomas W. Lamont, one of Mr. Wilson's financial advisers at the Peace Conference, gave assurance that the United States had made absolutely no secret or public agreement "that the Allied indebtedness should in whole or in part be cancelled."

COLUMBIAN TREATY REPORTED.—Washington, March 7.—The Senate Committee on Foreign Relations reported out favorably to-day various treaties, some of which have been pending for years, including the Colombia Treaty.

The Colombian Treaty as reported to the Senate is with a few exceptions the same treaty as was sent to the Senate by President Wilson on June 16, 1914. Article I of the original treaty, which expressed to Colombia "in the name of the people of the United States, sincere regret that anything should have occurred to interrupt or mar the relations of cordial friendship that had so long subsisted between the two nations" is eliminated. This was the section that was so bitterly opposed by friends of Colonel Roosevelt, the reference in the section being to the Panama insurrection of November, 1903.

In the original treaty the United States was obligated to pay Colombia $25,000,000 in gold within six months after the exchange of ratifications. In the amended treaty the money will be paid in five instalments of $5,000,000 each, the first in six months after ratifications and the other four in annual payments.—*N. Y. Times,* March 8, 1920.

PANAMA-COSTA RICA DISPUTE

BORDER CONFLICTS.—On February 20 Costa Rican forces invaded and took possession of the town of Coto on the Pacific side of the Panama-Costa Rica frontier. A week later they were driven out by a cavalry troop of Panamans with the loss of two men and 35 prisoners. It was reported on March 6 that Costa Rican forces had advanced into Panama territory on the Atlantic side of the isthmus and occupied Bocas del Toro and Almirante.

CAUSE OF DISPUTE.—Until the recent disturbance, the two countries had observed a "status quo" frontier agreed upon in the early eighties of the last century. A commission headed by President Loubet of France in 1900 awarded the Coto district to Costa Rica and a region north and west of the River Sixaola on the Atlantic side to Panama. This was confirmed by an arbitration decision of Chief Justice White in 1914. Panama, however, has refused to evacuate the Coto territory until Costa Rica gave up the territory on the Atlantic side.

AMERICAN INTERVENTION.—Following the seizure of Coto by Costa Rica the United States Government sent notes to each country insisting that peaceable means be adopted to settle their conflicting claims. The reply of Panama is stated to have expressed willingness to accept the good offices of the United States, while that of Costo Rica was less favorable.

Second identic notes were despatched by Secretary Hughes on March 5 insisting that the troops of each nation retire within the frontiers as fixed by the White decision. To this proposal Costo Rica gave her consent in a reply of March 7 and issued orders for the withdrawal of troops.

JAPAN

APOLOGY IN LANGDON CASE.—On February 22 the American State Department issued the following announcement regarding the action taken by Japan following the killing of Lieut. W. H. Langdon, U. S. N., by a Japanese sentry at Vladivostok:

"A most thorough and exhaustive examination was conducted by the court-martial, resulting in the removal from the active list of the Japanese army of Major Gen. Nishihara, commanding the Japanese garrison at Vladivostok. The court held that General Nishihara had been guilty of a misinterpretation of the barracks service regulations and had thus incurred primary responsibility for the unfortunate incident. He has been deprived of the command of the garrison and of the rank of Brigade Commander, which he previously held. The barracks officer of the rank of Major has been adjudged guilty of responsibility in the matter and sentenced to confinement for thirty days. The assistant barracks officer, a Lieutenant, and the regimental commander have both been sentenced to a similar punishment for a period of twenty days. The company commander has been sentenced to a lesser period.

"The commander-in-chief of the Japanese Expeditionary Force in Vladivostok has paid a visit to the U. S. S. *Albany* and expressed to the commanding officer of the ship his regret at the occurrence of the incident. The sentry who fired the fatal shot has been held to be excused by the orders and actions of his superiors, upon whom responsibility has been squarely placed and who are to be punished as stated. The sentry, however, was found guilty of deception in his testimony as to the circumstances of the fatality and for this has been sentenced to confinement for thirty days.

"In addition to the expressions of regret on the part of the commander-in-chief of the Japanese Expeditionary Force, the Minister for Foreign Affairs in communicating the action of the court-martial conveys to the American Government 'the expression of deep regret on the part of the Japanese Government at the occurrence of this sad event,' and expresses the hope 'that the government of the United States will fully appreciate the sincere spirit in which the Japanese Government has acted in dealing with this most unfortunate incident.'"

Secretary Colby added that the subject of reparation was still under discussion and not concluded.

"The action of the Japanese authorities has been prompt and sincere," he said. "It will undoubtedly be received with appreciation in this country."

JAPANESE CENSUS RETURNS.—Washington, March 1.—The Japanese Government has just completed the taking of the first census of Japan proper, Korea, Formosa and Saghalien. The total population for Japan proper is given as 55,961,140, but for the whole empire, embracing Korea, Formosa and Saghalien, the population is given as 77,005,112.

Japan proper	55,961,140
Korea	17,284,207
Formosa	3,654,000
Saghalien	105,765
Total	77,005,112

Tokio, the capital, was supposed to approach 3,000,000 in population, but the census shows only 2,173,162.—*N. Y. Times*, March 2, 1921.

REVIEW OF BOOKS

"The Engineering Draughtsman." By E. Rowarth. Price, $5.00. (E. P. Dutton & Co., New York.)

This work, by one of the staff of Battersea Polytechnic, is intended for students already familiar with the elementary principles of Engineering Drawing. It consists mainly of full page plates, nearly 100 in all, from drawings chosen from many branches of engineering. The subjects are all of recent date and there are examples from locomotive, marine, and stationary engine practise and from automobile, airplane and electrical machinery, etc.

Each plate has on its facing page the minimum amount of text required to explain it. Half of the text is the "Bill of Materials," or "Schedule" as they say in England, and half consists of hints as to the operation of the machine. Purposely the student is left to do the real "reading" of the drawing himself, the benefit to him being dependent on his doing so.

To teachers the work will be welcome as a mine of good subjects, carefully chosen and carefully presented. The drawings are clear, fully dimensioned, some in inches and some in millimeters.

The evidences of European engineering practise, and of English nomenclature and methods of drawing will not often trouble the American student. Usually they are easily discounted and the knowledge of how they do things in England is likely to benefit us on this side, though we may not choose to follow the example in most cases.

In adapting some of the drawings to a page of the same size as this NAVAL INSTITUTE PROCEEDINGS, views have been moved from their rightful position, but this should not trouble the mature students for whom the book is intended.

One feature of English practise, however, should be kept in mind, or the drawings will be read with difficulty. As a rule "first angle" projection has been used. To us, who habitually use "third angle" projection, most of the views are on the wrong sides of their adjacent views. Our third angle method leads to the common sense rule that the right view is to the right, the top view on top, etc. If a front elevation has been drawn already and we wish to add a view as seen from the right, we put it to the right, and so on. If we want an oblique view, as seen from the northwest corner of the sheet, we put it to the northwest of the adjacent view from which it is projected. First angle projection leads to the opposite rule. The right view is to the left and the left view to the right.

Roughly speaking, first angle projection is used consistently on the continent of Europe, third angle projection in America, and both in England.

I speak of engineering practise. In schools where descriptive geometry is regarded as primarily a branch of mathematics, first angle projection is in use here also.

In the introduction where this author explains his arrangement of views he concedes of the third angle method that "it is more convenient to use in certain cases than is the first method. As an example consider the case of the general arrangement drawing of a locomotive where, in addition to a longitudinal elevation, an end elevation looking on the smoke box and an end elevation looking on the foot plate end may be required. It is obviously easier to read the drawing if the views are arranged by Method No. 2 rather than by Method No. 1, and there are numerous similar examples of a like character which might be named."

Curiously enough, a drawing of a locomotive with the view of the head end (cowcatcher) behind the tender and a rear view of the tender in front of the cowcatcher (first angle method) was the one which caused the writer of this review, trained at school in the first angle method, to discard from his own work, twenty-five years ago, all use of first angle projection for practical engineering drawing.

Descriptive geometry was developed a little over 100 years ago in France. In theory the two methods are of equal value, and the French mathematicians chose first angle projection as the standard method, an unfortunate choice for the practical man. This is clearly a case where the theorist should adapt himself to the practical man and third angle projection should become the standard method in text books. The common sense of the practical man has made third angle projection, notwithstanding all the weight of book authority to the contrary, the standard in American drafting rooms, is overturning English practise and making some impression even in France. I hope to see it universal.

In the case of the present text book, the actual drawing work expected of the student is either the making of some details from assembly drawings, or assembling from details of parts, or designing for a slightly different size of machine. There is no reason why this work should not be altogether third angle work, and the student held rigidly to our standard method.

Students of mechanism who want to become designers, and to convert skeleton or line drawings of mechanisms into actual machine drawings will find much to learn from these plates. I refer particularly to those smaller points of design which do not lend themselves to mathematical calculation, or do not warrant treatment in works on Machine Design.

F. W. J.

"A Treatise on Airscrews." By W. E. Park. (E. P. Dutton & Co.)

This is another volume in the excellent "Directly Useful Technical Series" of books and in accordance with the plan of this series combines as much theory as it is useful to know with a very complete and detailed exposition of the principles and methods to follow in the design and construction of propellers for aircraft. The bulk of the work is essentially

practical and arranged to be placed in the hands of the student or designer who desires actually to get out a design for an air propeller.

The particular application of the "blade element" theory developed in this book and the detailed method of construction advocated are, of course, highly controversial in some of their aspects, but for the practical man who must get on with his job it is necessary to accept something on faith. This element of faith is justified by the statement by the author in his introduction that the treatment follows the methods developed by the firm of Lang Propeller, Ltd., an experienced concern.

To the general student of propulsion, the book is of interest as an exposition of the practical application of the blade element theory of the propeller due originally to Drzwiecki. This particular theory, so-called, is still incomplete in many respects but stands to-day as the only useful propeller theory available, and from it aircraft propellers have been and are being designed with very good results.

Compared with such theory of the marine screw propeller as is used in the design of ships' propellers, the marine engineers appear to be in a stone age state of development where elaborate rule of thumb still rules.

J. C. H.

"L'Emden Ses Croisières et Sa Fin." By Paul Ardoin, Enseigne de Vaisseau de Réserve. (Augustin Challamel, 17 Rue Jacob, Paris.)

The cruise of the *Emden* has been described in the narrative of Lieutenant Von Mücke, the executive officer of that vessel, who has graphically related the exploits of the raider, as well as his own adventures subsequent to the loss of the *Emden*. Commander Klein's careful translation has rendered this narrative available to readers of the U. S. NAVAL INSTITUTE PROCEEDINGS. Many other articles have been written concerning the exploits of the *Emden*, but it is doubtful if readers will tire of learning new details, as well as of reviewing the old, concerning the career of the *Emden*, forming as it does one of the few bright spots in the erratic history of the German Navy in the late war.

This work of a French author presents the history of the *Emden* from a new angle, even though the book, like its companion volume descriptive of the career of Von Spee's squadron, was written while the author was in a German prison camp, and is consequently derived to a great extent from German sources.

The introduction touches upon the active and efficient services rendered by the *Emden* in Chinese waters before the declaration of war. A few paragraphs are devoted to describing the character of Von Müller the captain of the *Emden*, contrasting it with that of Von Spee, somewhat to the disadvantage of the latter, so far as the qualities of energy and determination are concerned. There follow many quotations showing the high opinion and regard held by the crew of the *Emden* for their captain's tireless energy and ability. Tribute is also paid to Von Mücke, with particular reference to the great ability displayed by the latter in taking an unseaworthy sailing vessel like the *Ayesha* from the Cocos Islands to Hodeida.

The history of the *Emden* is then traced from the news of the declaration of war and the first prize, captured just off Tsing-Tao.

Shortly thereafter the *Emden* was ordered to rendezvous with Von Spee's squadron at the Marianas Islands, but at Von Müller's own suggestion he was given permission to proceed on detached duty, and thereupon began the *Emden's* three months' highly successful career as a raider.

The German cruiser was rendered easy to identify by the fact that she had three smokepipes whereas similar vessels of the British navy had either two or four. Consequently, a dummy smokepipe was rigged, which could be hoisted and lowered at will, making the *Emden* greatly resemble a British cruiser of the *Yarmouth* class.

The first important prizes were captured in the Bay of Bengal. It was Von Müller's practice to sink his prizes, retaining the crew of each on board the *Emden* until a certain number of men had been assembled, when he saved one prize from destruction and sent all his prisoners on that vessel to the nearest neutral or enemy port. For all vessels destroyed and for all merchandise taken over he gave receipts. Officers and men who were his prisoners praise highly his courtesy and his considerate treatment.

In order to obtain news of enemy merchantmen and neutral vessels carrying contraband it was his practice to lie off a port and listen in with his radio for messages. He also learned a great deal about the movements of ships from indiscreet remarks of some of the shipmasters who had been captured. He used his radio at times to misdirect his contemplated prizes and bring them within the radius of operation of his own ship.

After his exploits in the Bay of Bengal, Von Müller stood into Madras and shelled the large oil tanks the British owned at that place. Although a few private houses were hit, the bombardment of Madras was sanctioned by international law because the main objective was the destruction of the large fuel oil depot. From Madras Von Müller proceeded to Colombo, Ceylon, where he sank four English ships. At this time no less than sixteen men-of-war, English, French, Russian and Japanese were pursuing the *Emden*.

The chase was becoming too hot, so, leaving the main shipping routes, Von Müller put in to the British island of Diego Garcia, situated in the Indian Ocean between Mauritius and India. Here there were but two mails a year; consequently the governor did not know that war had been declared. No sooner had the German raider anchored than the governor went out to visit her, bringing many presents of fish, eggs, fruit and other supplies, stating that he was very glad to see a German ship in port, since this was the first visit since 1889, when relations had been very pleasant. After leaving Diego Garcia, the *Emden* captured another English merchantman whose master disclosed the fact that he was following the new routing instructions. Soon afterwards, thanks to this information, the *Emden* captured and sank six vessels in rapid succession.

All this time the British press, although admitting that Von Müller was acting strictly in accordance with the laws of war, was vigorously

attacking the Admiralty because the allied navies had been unable to capture or destroy the *Emden*.

At the very time that the criticism of the British press happened to be the most severe, the *Emden* dashed into Penang and torpedoed the Russian cruiser *Jemtschoug*.

The French gunboat *D'Iberville* opened fire, but the *Emden* escaped and sank a French destroyer, the *Mousquet*.

Von Müller then planned an attack on the radio and cable station at the Cocos Islands. Von Mücke, the executive officer, was sent ashore with a landing force to destroy the radio station. The Australian cruiser *Sydney* received a despatch giving notification of the arrival of the *Emden* at the Cocos Islands, but was unable to intercept the raider before Von Mücke had destroyed the radio station and made an unsuccessful attempt against the cables.

When he realized the near approach of the *Sydney*, Von Müller signalled his executive officer to return, but the latter found it impossible to comply with these orders.

The *Sydney* was superior to the *Emden* in speed and gun power. After a gallant fight, Von Müller finally beached his ship on North Keeling Island, and at last surrendered in order to save the surviving members of his crew. In view of the gallantry displayed by the *Emden*, the surviving German officers were allowed to retain their side arms when they were taken on board the *Sydney*.

Von Mücke and his landing party, unable to return to their ship, watched the action from the island. At its conclusion Von Mücke and his men embarked in the old three-masted schooner, *Ayesha*, and decided to attempt their escape in that vessel. Navigational instruments and charts were old. The men were without proper clothing. Food and water were scarce.

However, despite these and other difficulties, Von Mücke and his men made Padang, a port of Sumatra, where they took stores and remained for twenty-four hours. At Padang they found the *Choising*, a German merchantman which had been detailed to act as a collier for the *Emden*. After leaving Padang, en route for the Gulf of Aden, the *Ayesha*, in accordance with a pre-arranged plan, fell in with the *Choising*, and to this steamer Von Mücke transferred his men. The *Choising* passed through the straits of Bab-el-Mandeb and finally arrived at Hodeida, and thence, after many adventures, Von Mücke and his men made their way overland to Constantinople.

The book is written in the same easy style as its companion volume describing the career of Von Spee's squadron.

Even though officers are familiar with Commander Klein's translation of Von Mücke's work, a perusal of this volume will be of benefit for reviewing from the standpoint of a French naval officer, the exploits of the *Emden*, which are well worthy of careful study.

N. R. V.

"The Crisis of the Naval War." By Admiral Jellicoe. Price, $7.50. (George H. Doran Company.)

This interesting book is the complement of his first volume, "The Grand Fleet, 1914-1916." Admiral Jellicoe, the one man who was best situated to know, now draws aside the curtains and reveals to us the efforts made by the Admiralty to overcome the threat made by the German Submarine Campaign. The account not only deals with the origin ashore of the defense and offense against submarines, but follows to sea the measures adopted where their application and results are shown.

The first chapter deals at length with the changes made in the admiralty that the organization might be logical and smooth working to avoid conflict of authority, to have no necessary service neglected, to provide the necessary corps of investigators of new devices, and above all to free the first Sea Lord and his assistants of a mass of detail that their efforts might be concentrated on the larger questions.

The appendices are of value and interesting because they show the organization at different periods and emphasize the fact that the Naval Staff at the end of the war was the result of trial and error, natural growth, and at least one radical change adopted during war.

Chapters II and III deal with the Submarine Campaign in 1917 and the measures adopted to win success. The gradual naval control of all merchant shipping with its attendant difficulties is clearly shown. The tremendous labor involved in putting into operation new measures; the unremitting search for and development of new anti-submarine devices is revealed, and above all the length of time necessary to put into operation any new device, and this when time is the most precious element, is pointed out.

That a campaign against the enemy must be waged with every means at hand; that new weapons must be continually sought; that no "cure-all" by which the enemy may be defeated without fighting can be expected; that during war is the poorest time to provide the material which should be provided during peace, the Admiral shows in a manner not to be gainsaid.

Chapters IV and V deal with the testing, introduction, and gradual growth of the Convoy System. It is shown how the introduction of this system was delayed by lack of vessels to perform escort duty and why when finally adopted it was so successful because it was not only defensive but offensive in that it meant a fight for a submarine to attack a vessel under convoy.

Chapter VI is devoted to the entry of the United States. The accurate estimate of our naval strength by both the enemy and the allies, and our inability upon the declaration of war to lend any great assistance are shown—and this at the most critical period for the Allies—a period when the German submarine campaign was at its height, when the tonnage lost monthly by the Allies was far in excess of what could be replaced—when the destruction of merchant shipping if continued at the then present rate would in a few months mean the defeat of the Allies.

The close cooperation between the British and United States leaders and forces with the resultant benefit to both is explained in detail.

The remaining chapters treat of patrol craft and mine sweeping services; the Dover patrol and Harwich forces; the sequel; production during 1917; the future.

The tremendous labors, "carrying on" under adverse conditions, disappointments and successes of the different forces are given full credit and a just appreciation by their leader. One heaves a sigh of relief when he reads "The Sequel" in which the ultimate success over the enemy submarines is gained as the result of prodigious efforts carried out under the most heart breaking conditions.

No one interested in the naval campaigns of the Great War should fail to read this book, and learn therefrom.

T. L. J.

"Old Naval Days." By de Meissner. Price, $3.00. (Henry Holt & Co.)

In this pleasing account of the life of one of our well-known naval officers, whose services extended from 1825 to 1872, we are introduced anew to most of the naval heroes and many other noted men who had large parts in the upbuilding of our United States.

The story of Admiral Radford's life is interwoven with delightful sketches of life in St. Louis and Virginias during the early part of the century; the Lewis and Clark expedition; the naval actions during the War of 1812 and against the Barbary Coast; the conquest of California; the Mexican and Civil wars. To read this book is a pleasant way to review much of the history of the United States during its period of growth.

T. L. J.

"Modern Marine Engineering. Part I: 'The Fire Room.'" By Harry G. Cisin, Marine and Mechanical Engineer. Price $3.00. (Published by D. Van Nostrand Company, 8 Warren Street, New York.)

As stated in the preface, the purpose of this book is: "To reflect present day practice." While intended primarily as a text-book for schools and colleges, it has been adapted to the needs of the practical man who desires to broaden his knowledge and to advance himself in his profession. The language is clear, readable and simple so that it is practically self-instructing. The subject matter is fully discussed in chapters with a complete set of questions at the end of each chapter.

This volume "I: The Fire Room" contains a detailed discussion of the following subjects, marine boiler construction (fire and water tube), various water-tube boilers, and also sections on boiler-room auxiliaries, boiler corrosion, fuels (coal and oil), and combustion. A detailed description of the construction of a B. and W. boiler is given while only general descriptions of express type boilers are given. For the more advanced student the final chapter discusses the general theory, calculations, and the steam tables.

The book is illustrated by 66 illustrations which are very clear and useful. There are a few inaccuracies where illustrations do not agree with text but it is presumed these will be corrected in the next edition. The construction details shown in these illustrations should be useful to marine engineering draftsmen, as well as to others engaged in marine engineering construction.

The 192 pages of text are fully indexed. Also an index of the illustrations is furnished.

W. L. F.

"The Theory and Practice of Aeroplane Design." By Andrews and Benson. Price, $7.00. (New York: E. P. Dutton, 1920.)

If the title were less comprehensive and if the preface did not promise so much, one could say that this is a useful reference book to add to the library of an experienced aeronautical engineer. However, its claim to supply a text of both theory and practice falls very short of adequate realization.

The theoretical side is especially weak. In particular the book is almost silent as to the fundamental laws of aerodynamics. The theory of structures given in the chapter on wing strength is rather sketchy and all but ignores the part played by the stagger wires. The stability theory given is largely a reproduction in abstract of matter published before 1917. This last is hardly illuminating, as the practical application of this highly involved mathematics has yet to be made. The authors make no attempt.

On the whole, the book does give a fair idea of how some British airplanes may have been designed in the past. However, it is hoped that in future airplane design will have a more straightforward procedure, and it is to be regretted that the authors have not attempted to digest the vast quantity of experience and data available. The book is in no sense a text suitable for teaching and could be much improved by a 50 per cent condensation of what is given.

There is unfortunately still no text in English fairly comparable with Professor Pröll's "Flugtechnik."

J. C. H.

"Subject Index to Periodicals, 1917-1919." Issued by the Library Association, 33 Bloomsbury Square, London. List "B-E," historical, political and economic sciences.

This publication is the English "Reader's Guide to Periodical Literature," with the difference that instead of combining references to all the arts and sciences in one alphabetical arrangement and in one volume, as does Wilson's Reader's Guide, the English index is issued in separate "class lists." The list received by the Institute, List "B-E," historical, political and economic sciences, is that containing references to articles on the military and naval sciences. This method of listing references, while used to some extent on this side of the water, has drawbacks as distinct as its advantages, the chief inconvenience being that the user is

frequently uncertain whether or not he has the proper class list in hand, whereas Wilson's method puts it all together in one volume. True, if you are interested mainly in theology, you do not have to pay for thousands of references to music, or archæology, or fine arts, but who knows in what subject he will become interested tomorrow? For the matter covered, the present subject index is an admirable and accurate guide to what has appeared in the leading English, American and French periodicals, literary as well as technical and professional, during the three year period 1917-1919, and makes accessible to officers of the service a tremendous amount of valuable matter of close professional interest. More than four hundred periodicals carrying articles within the scope of the guide are covered, among them being the U. S. NAVAL INSTITUTE PROCEEDINGS, making the guide almost indispensable to one seeking material on any of the subjects covered in its classification. The index is a classified one merely, which is another way of saying that titles of articles and authors' names will not be found elsewhere than under the proper classified heading, although the Association publishes a general name index to the seven different class lists. The bulk and unwieldiness of the list, arising from the use of rather thick paper and large type are amply compensated for by the pleasing typographic effect of the printed page. It is evident that much care and thought has been given to the method of classification which is, in the main, clear and readily understood after a short examination. The compilers deserve encouragement from both arms of the service in the publication of this bibliography which will save time to many an inquiring officer seeking material on recent developments in his profession. The subject list will be kept on file in the office of the Naval Institute and will be available to any officer desiring to make use of it. A considerable number of the periodicals indexed will be found in the Naval Academy Library.

J. M. S.

"A Handbook of Practical Shipbuilding with a Glossary of Terms." By J. D. MacBride. Price, $3.00. (Published by E. H. Van Nostrand Company, New York.)

This is a second edition of a book which was first published in the latter part of 1918. The new edition contains additional information and more comprehensive treatment of some subjects. The author was Superintendent of Hull Construction at the Hog Island Shipyards, and in connection with construction work in hand there, and at other yards, that was being undertaken by a force of men, on the whole, inexperienced in modern steel ship construction, the need was felt for a guide or set of instructions explaining in detail the methods followed in assembling and fastening the various parts of a ship and the tools and appliances used in its construction.

The general organization of a shipyard is first discussed, then a chapter outlining in considerable detail the duties required of the several classes of workmen at the building ways is followed by one describing with numerous illustrations the shipyard tools. Then follow chapters on Keels,

Shell Plating, Floors, Framing, and the other major elements of the ship, together with very practical chapters on Stopwaters and Testing; Launching is briefly treated; and separate chapters are devoted to Engine and Boiler Room Installations; Auxiliary Machinery; Piping Systems; Hull Engineering; and Dock Trials, all intended to cover the subjects treated in a general way so that the workmen may have a general knowledge of what is involved in completing the ship.

The book covers the work done at the building ways, work done in actually putting together the various parts of the ship which have been fabricated "elsewhere." It has been prepared as a result of the very extended and varied experience of the writer in practical shipbuilding and while intended primarily for "green" men, contains much information of a practical nature for those with more experience.

W. G. D.

"Simple Rules and Problems in Navigation." By Charles H. Cugle. Price, $5.00. (E. P. Dutton & Co., New York, N. Y.)

This book is a good one for the instruction and training of merchant navigators who attack the problems of navigation without the benefits of a previous study of mathematics and astronomy. It is devoted to practical examples which may be used as guides. The data furnished can be used to advantage by naval officers studying for promotion particularly as the answers are brought up to the 1921 almanac.

The method of running the morning line up to noon commonly used in the navy, should have been included as it is simpler and better than the method of latitude and longitude, differences illustrated. In this connection it is noted that the author calls a line drawn at right angles to the bearing of a heavenly body, a "line of bearing." The generally accepted name for such a line is a "line of position."

The rules of the road and other similar information which is included enhances the value of the book for men going up for licenses.

A. M. R. A.

"Manpower." By Lincoln C. Andrews, author of "Military Manpower," "Basic Course for Cavalry," etc. (E. P. Dutton & Co., New York.)

The author, in his foreword, states the purpose of his book to be the adaptation of the ideas and methods so successfully employed in military training and leadership to the uses of civil life.

He states it to be his belief, and his views are undoubtedly correct, that the fundamental principles for handling men are universal in application, that is, we are in all cases dealing with *men*.

He regards leadership as an art, not an exact science, wherein the leader's impulses are right and these impulses come from a genuine acceptance of principles, from one's own beliefs, feelings and experiences. In other words, for the leader it is a question

(1) Of personal understanding and sincerity of purpose to play the game fairly;

(2) Of having a sympathetic understanding of the human animal and of what the laws of life make him do under certain circumstances; and

(3) Of having an appreciation of one's own personality and how it affects others.

The book is in three parts:

I. Using Human Tools.

II. Psychological Elements of Organization.

III. The Principles of Leadership.

The author's treatment of his subject is throughout based on *quality*, not quantity, of manpower—how to handle men to effect that willing response which is the only true discipline. His book will be very helpful to all who have long known that the proper handling of men was necessary for the highest efficiency—and have not yet found any practical ideas as to *how to do it.*

Part III, in particular, contains numerous items of advice that can with profit be learned and pondered well by all whose duties call upon them to supervise their fellowmen.

E. J. K.

"Little History of the Great War." By H. Vast, Translated from the French by Raymond Weeks, Professor, Columbia University. Price, $2.00. (Published by Henry Holt and Company.)

This book is called a "Little History," and covering, as it does, in about two hundred and fifty pages, a subject of the magnitude and importance as that of world happenings during the period August, 1914 to November, 1918, it is necessarily condensed and treats only of the principal individuals and the most important campaigns and events.

The book first appeared in Paris in November, 1918, and was intended to present a concise statement of events leading up to the conflict, an outline of Germany's long preparation for war, her perfidy, and a popular treatise of the military operations in all theatres. It does not pretend to be a technical or scientific history of the war, but has been written, as the author states, more from information obtained from articles appearing in the public press than from official documents. There are numerous maps that help out the text covering the subjects under discussion, and while some inaccuracies appear, probably due to the sources from which information has been obtained, the data as a whole appears reliable and is presented in a logical sequence.

Naval operations are but very briefly mentioned, the greater portion of the book dealing with the political and military aspects of the war. The subject is one of too great magnitude to be covered in a book of this extent, except in a very brief way, but for preliminary reading to add to one's general knowledge or to help clear up the maze of ideas about the war and events connected therewith, prior to a more extensive or detailed study thereof, this little book will undoubtedly be found both interesting and instructive.

W. G. D.

"A True Account of the Battle of Jutland." By Captain T. G. Frothingham, U. S. R. Price, $1.00. (Published by Bacon & Brown.)

The heated controversy raging in England over the tactics and results of the Battle of Jutland appears to have divided British opinion into two opposing factions; the one *pro*, the other *contra* Jellicoe. This is not surprising when one recalls the gloom which followed upon Mr. Balfour's announcement of the losses sustained in that action and his colorless statement of achievement.

When the British public learned that the two fleets had come into actual contact, with the superiority on its own side, it naturally expected a repetition of the days of Nelson, and it was bitterly disappointed, if not shocked, when, later, the negative outcome became known. In consequence, there are now two schools of naval thought in Great Britain. The first strongly condemns the Admiralty of that period for lack of preparation in certain essentials; for a false doctrine of the rôle the navy ought to play; and for trusting too much to material and too little to men and morale, while not sparing the commander-in-chief because he did not possess or exhibit that traditional spirit of the offence which brought victory to Drake, Hawke and their successors. Although bearing witness to his candor, integrity and character, this school holds him personally responsible for allowing to slip through his fingers the greatest naval triumph of all time. The second school seeks to explain that Jellicoe was right; that he could do no differently, in the light of his information on that eventful May day, in 1916, and of the policy he was directed by the Admiralty to carry into effect.

Under the circumstances, any account of the action by British hands, however competent, cannot escape the implication of prejudice; hence it is to foreigners that we must look for studies devoid of bias. Such are Lieut. Commander Frost's "High Sea Fleet at Jutland," (U. S. NAVAL INSTITUTE PROCEEDINGS, Nov., 1920); Commander Gill's "What Happened at Jutland," and Capt. T. G. Frothingham's "A True Account of the Battle of Jutland." The latter is under particular consideration in these lines.

In this connection three questions present themselves at once. "Is the author fair minded and capable?" "Are all available facts employed by him in reaching his conclusion?" "Are there sufficient known facts to warrant his reaching any conclusion at all?" A careful reading of Capt. Frothingham's text supplies an affirmative answer to the first and second queries mentioned. As to the third, it may be safely assumed that, thanks to the British official report and to the books, however *ex parte*, of Jellicoe, Scheer, von Tirpitz, etc., nothing of vital importance remains to be told of the main course of events. Doubtless many minor occurrences may yet be made public, but none, it is likely, to affect materially the general estimate held by the author.

He describes the military and naval situation just prior to the action, the practices adopted by the rival commanders-in-chief and their respective aims. His story of the battle must be substantially correct, since it is based on unquestioned records and is in agreement with the accounts given

by Frost and Gill. It is well worth the reading for it is both terse and clear. Of especial interest to the profession are the sudden changes of course by Scheer, "vessels right about," a difficult and frequently rehearsed movement which baffled Jellicoe at three critical moments of the fight.

The author gives generous space to Jellicoe's utterances, official and personal. His criticisms are few in number and not caustic, although he does not share the general laudation of Beatty's tactics believing that the latter should have kept Jellicoe better informed, especially as to the location and heading of the Germans and that he should have made more use of his fast battleships under Evan-Thomas. The author's most serious charge, based on Jellicoe's expression, is "not alone the lack of modern methods in range finding and director fire control, but in preparation for action under night conditions." Whether these deficiencies could not have been made up by a more resolute determination to close with the enemy at all costs is a question which will never be answered. Again, he uses Jellicoe's own words to point out, tacitly, that the British admiral seemed more intent on avoiding injury to his vessels than to engage the enemy at close quarters, and push the fight to a finish—a reluctance founded largely on dread of torpedoes and mines.

The importance of accurate and timely intelligence is accentuated by the unexplained error of twelve miles in Beatty's position which caused Hood to miss him and greatly embarrassed Jellicoe in his efforts to join his subordinate.

It is no part of these comments to recount the incidents of what might have been a second Trafalgar. Rather, are they meant to call the attention of our readers to a story of the clash of the two greatest armadas in all history, an account which can be accepted as conscientiously exact. Indeed, it will be found exceedingly valuable in providing a general *coup d'œil* of the engagement for those who purpose, subsequently, to go deeper into its details.

C. F. G.

"What Happened at Jutland." By Commander C. C. Gill, U. S. Navy. Price $3.00. (George H. Doran & Company.)

"The action was indecisive. Therefore, it had no decisive influence upon the naval situation or the general course of the war."

This the judgment of Commander C. C. Gill, U. S. N., the author of "Naval Power in the War," and well known as a qualified analyst of naval affairs.

Commander Gill has critically examined the tactics employed by the parties of the first and second parts of the Battle of Jutland and finds that, although the engagement ranks with the greatest battles in history, the fact is not generally realized as the action was not decisive. The result is that this contest, which was the only major fleet engagement throughout the entire war, in the opinion of Commander Gill, had no effect on its course.

In his study of the battle, the author has used every reliable source of information including official reports and the books by both commanders-in-chief in which Jellicoe and Scheer fully discussed their maneuvers and described the battle from their respective viewpoints.

With this material, Commander Gill has made an impartial survey, filling in the gaps which must of necessity obtain in the movements of the forces; has graphically analyzed each phase of the contest; and has reached an unbiased conclusion as to results, both in regard to the major tactics employed and in detail as to types engaged.

This interesting work begins with the strategic disposition of the fleets before the battle and discusses the tactics of the battle itself in five phases from the encounter of the advanced forces under Beatty and Hipper through the withdrawal of Jellicoe to the southward that night. The series of 26 diagrams of formations and maneuvers which accompany the text are distinct contributions to the graphic narrative and will be invaluable to students of this momentous contact of giant fleets. Included in an appendix is a summation of the losses and damage to individual vessels on both sides and also excerpts from an authoritative paper prepared by Rear Admiral Taylor, the Chief Constructor of the navy, entitled "Design of Warships as Affected by Jutland."

Commander Gill's conclusions will be given respectful and widespread attention, as many important questions of future naval policy and design will undoubtedly be based on the experience of Jutland.

"What Happened at Jutland" should be read by every line officer of our service.

W. T. C.

"A Treatise on Hand Lettering." By Wilfrid J. Lineham. Price, $7.00. (E. P. Dutton & Co., New York.)

The author of this work will be remembered by many naval officers as the writer of a work on mechanical engineering which was used as a text book at the Naval Academy for many years, before Barton's Mechanical Processes was written. Prof. Lineham is head of the Engineering Department of the University of London, Goldsmiths' College.

The book is published "for engineers, architects, surveyors and students of mechanical drawing" and is one of a "directly useful technical series" edited by Prof. Lineham, a series intended to "occupy a midway position between theoretical books and severely practical ones."

The plates of lettering number about 110 of 6" x 10", and there are half a dozen large folders showing the application of lettering to technical drawings. The hand work and the work of reproduction are excellent. I do not see how they could be better. The lettering which is to serve as a model for practise by copying, varies from ¼" to 1" in height, since large scale lettering is always advisable for the novice.

A third of the plates are what the author calls Block Capitals, either Italic or Vertical, with American Italic or Vertical Smalls. This combination is what we are familiar with in this country under the name of Reinhardt, or one stroke lettering. Officers and engineers in general, if in a position to require examples of fine lettering as models, will find these of use. They have the severity and dignity which suits technical drawing, together with the power of great photographic reduction without loss of legibility.

Another third of the plates is devoted to Roman Italic and Roman Vertical Capitals and Smalls. These will be of value to architects and surveyors.

The remaining third is devoted to types of use only to specialists, such as decorators, poster designers, movie film writers and the like. The examples keep in curb the common tendency to over-ornamentation and over-exuberance. It is to be hoped that such letterers may get this book and use it.

While this work may be called a "midway" book in England, in this country there will hardly be a demand for any more theory in this subject. Good taste is the criterion and it is a subject which does not lend itself to theory very well. The value of the plates is all in their good taste and fine workmanship.

T. W. J.

NOTICE

The U. S. Naval Institute was established in 1873, having for its object the advancement of professional and scientific knowledge in the Navy. It is now in its forty-eighth year of existence. The members of the Board of Control cordially invite the co-operation and aid of their brother officers and others interested in the Navy, in furtherance of the aims of the Institute, by the contribution of papers upon subjects of interest to the naval profession, as well as by personal support.

On the subject of membership the Constitution reads as follows:

ARTICLE VII

Sec. 1. The Institute shall consist of regular, life, honorary and associate members.

Sec. 2. Officers of the Navy, Marine Corps, and all civil officers attached to the Naval Service, shall be entitled to become regular or life members, without ballot, on payment of dues or fees to the Secretary and Treasurer. Members who resign from the Navy, subsequent to joining the Institute, will be regarded as belonging to the class described in this Section.

Sec. 3. The Prize Essayist of each year shall be a life member without payment of fee.

Sec. 4. Honorary members shall be selected from distinguished Naval and Military Officers, and from eminent men of learning in civil life. The Secretary of the Navy shall be, *ex officio*, an honorary member. Their number shall not exceed thirty (30). Nominations for honorary members must be favorably reported by the Board of Control. To be declared elected, they must receive the affirmative vote of three-quarters of the members represented at regular or stated meetings, either in person or by proxy.

Sec. 5. Associate members shall be elected from Officers of the Army, Revenue Cutter Service, foreign officers of the Naval and Military professions, and from persons in civil life who may be interested in the purposes of the Institute.

Sec. 6. Those entitled to become associate members may be elected life members, provided that the number not officially connected with the Navy and Marine Corps shall not at any time exceed one hundred (100).

Sec. 7. Associate members and life members, other than those entitled to regular membership, shall be elected as follows: "Nominations shall be made in writing to the Secretary and Treasurer, with the name of the member making them, and such nominations shall be submitted to the Board of Control. The Board of Control will at each regular meeting ballot on the nominations submitted for election, and nominees receiving a majority of the votes of the board membership shall be considered elected to membership in the United States Naval Institute."

Sec. 8. The annual dues for regular and associate members shall be three dollars, all of which shall be for a year's subscription to the UNITED STATES NAVAL INSTITUTE PROCEEDINGS, payable upon joining the Institute, and upon the first day of each succeeding January. The fee for life membership shall be forty dollars, but if any regular or associate member has paid his dues for the year in which he wishes to be transferred to life membership, or has paid his dues for any future year or years, the amount so paid shall be deducted from the fee for life membership.

Sec. 10. Members in arrears more than three years may, at the discretion of the Board of Control, be dropped for non-payment of dues. Membership continues until a member has been dismissed, dropped, or his resignation in writing has been received.

ARTICLE X

Sec. 2. One copy of the PROCEEDINGS, when published, shall be furnished to each regular and associate member (in return for dues paid), to each life member (in return for life membership fee paid), to honorary members, to each corresponding society of the Institute, and to such libraries and periodicals as may be determined upon by the Board of Control.

The PROCEEDINGS are published monthly. Subscription for non-members, $3.50; enlisted men, U. S. Navy, $3.00. Single copies, by purchase, 50 cents.

All letters should be addressed U. S. Naval Institute, Annapolis, Md., and all checks, drafts, and money orders should be made payable to the same.

SPECIAL NOTICE

NAVAL INSTITUTE PRIZE ARTICLE, 1922

A prize of two hundred dollars, with a gold medal and a life-membership (unless the author is already a life member) in the Institute, is offered by the Naval Institute for the best original article on any subject pertaining to the naval profession published in the PROCEEDINGS during the current year. The prize will be in addition to the author's compensation paid upon publication of the article.

On the opposite page are given suggested topics. Articles are not limited to these topics and no additional weight will be given an article in awarding the prize because it is written on one of these suggested topics over one written on any subject pertaining to the naval profession.

The following rules will govern this competition:

1. All original articles published in the PROCEEDINGS during 1921 shall be eligible for consideration for the prize.

2. No article received after October 1 will be available for publication in 1921. Articles received subsequent to October 1, if accepted, will be published as soon as practicable thereafter.

3. If, in the opinion of the Board of Control, the best article published during 1921 is not of sufficient merit to be awarded the prize, it may receive "Honorable Mention," or such other distinction as the Board may decide.

4. In case one or more articles receive "Honorable Mention," the writers thereof will receive a minimum prize of seventy-five dollars and a life-membership (unless the author is already a life member) in the Institute, the actual amounts of the awards to be decided by the Board of Control in each case.

5. The method adopted by the Board of Control in selecting the Prize Essay is as follows:

(a) Prior to the January meeting of the Board of Control each member will submit to the Secretary and Treasurer a list of the articles published during the year which, in the opinion of that member, are worthy of consideration for prize. From this a summarized list will be prepared giving titles, names of authors, and number of original lists on which each article appeared.

(b) At the January meeting of the Board of Control this summary will, by discussion, be narrowed down to a second list of not more than ten articles.

(c) Prior to the February meeting of the Board of Control, each member will submit his choice of five articles from the list of ten. These will be summarized as before.

(d) At the February meeting of the Board of Control this final summary will be considered. The Board will then decide by vote which articles shall finally be considered for prize and shall then proceed to determine the relative order of merit.

6. It is requested that all articles be submitted typewritten and in duplicate; articles submitted written in longhand and in single copy will, however, receive equal consideration.

7. In the event of the prize being awarded to the winner of a previous year, a gold clasp, suitably engraved, will be given in lieu of the gold medal.

By direction of the Board of Control.

H. K. HEWITT,
Commander, U. S. N., Secretary and Treasurer.